

The Economic Costs of Alcohol and Drug Abuse and Mental Illness: 1985



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1990

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CHAPTER I

SUMMARY

Alcohol abuse, drug abuse, and mental illness (ADM) are major causes of widespread illness, disability, and premature death in the United States. The burden on society of these disorders encompasses the use of costly medical resources, significant losses of productivity, serious motor vehicle accidents, fire destruction, and devastating criminal activity resulting in property destruction, and incarceration. Victims of these disorders experience pain and suffering. They may be forced into economic dependence, homelessness, social isolation, unwanted job changes, loss of opportunities for promotion and education, and other undesired disruptions in life plans. Families and friends of victims may also be affected and their lives disrupted. The monetary burden on society of many of the serious consequences of ADM disorders can be measured, although pain, suffering, and family disruption are not quantifiable.

OBJECTIVES OF THE STUDY

The objectives of the present study are:

- To measure as precisely as possible the economic costs to society of the ravages of ADM, three related behavioral disorders, by estimating the economic costs for 1985, the most recent year for which reliable data are available;
- To update previous cost estimates on the basis of comprehensive data sources and improved methodology;
- To develop an improved methodological approach to deal with the important issues of comorbidity (illnesses for which ADM disorders are secondary causes) and overlap of ADM disorders (individuals afflicted with two or three of these disorders); and
- To conduct a review of the literature on the economic costs of illness, with emphasis on studies related to ADM, and to provide a current descriptive list of recent empirical and methodological research in this area. In fulfillment of this objective, an annotated bibliography of cost-of-illness studies was prepared and submitted separately from this report to the Office of Financing and Coverage Policy. The annotated bibliography was prepared by Denise Jarvinen under the direction of Dorothy P. Rice and Sander Kelman.

CONDUCT OF THE STUDY

This report addresses the first three objectives described above. The development of ADM cost estimates is consistent with the concepts and methods employed by previous researchers (Cruze et al., 1981, and Harwood et al., 1984). The estimation methods are also consistent with the methodology formulated by the Public Health Service task force on cost-of-illness studies (Hodgson and Meiners, 1979).

Table 1

MAGNITUDE OF ADM DISORDERS IN THE UNITED STATES

	<u>1985 Estimate</u> (billions)	<u>1988 Estimate</u> (billions)
Economic Cost of ADM	\$218.1	\$273.3
Cost of Alcohol Abuse	\$70.3	\$85.8
Cost of Drug Abuse	\$44.1	\$58.3
Cost of Mental Illness	\$103.7	\$129.3
		<u>1985 Estimate</u>
Short-stay hospital discharges with a primary ADM diagnosis		1,871,000
Days of care for discharges with a primary ADM diagnosis		22,140,000
Discharges with a secondary ADM diagnosis		2,203,000
Days of care for discharges with a secondary ADM diagnosis		18,935,000
Ambulatory care visits to office-based physicians, including psychiatrists, with a primary or secondary ADM diagnosis		33,451,000
Residents in state and county mental hospitals		109,940
Nursing home residents with an ADM diagnosis		645,900
Person years served in prisons for crimes and offenses associated with ADM		232,530
Deaths caused by or related to ADM		140,593
Alcohol abuse deaths		94,768
Drug abuse deaths		6,118
Mental illness deaths		39,707
Person years lost due to ADM premature deaths		3,955,000
Alcohol abuse		2,675,000
Drug abuse		231,000
Mental illness		1,049,000
Person years lost per ADM death		28.1
Alcohol abuse		28.2
Drug abuse		37.8
Mental illness		26.4
Cost per ADM death		\$254,716
Cost per alcohol abuse death		253,076
Cost per drug abuse death		418,857
Cost per mental illness death		233,337

An Advisory Committee comprised of a nationally renowned interdisciplinary team of researchers was convened to provide guidance in the conduct of the study. The full Advisory Committee and the Subcommittee of Economists met several times. In addition, advice and counsel were sought via individual meetings and frequent telephone calls. Advisory Committee members contributed greatly to the development of improved methodology, especially in the estimation of morbidity costs.

ORGANIZATION OF THE REPORT

The present report is organized into nine chapters and four appendices. Chapter I is the Summary of the report. Chapter II discusses the conceptual issues related to cost-of-illness studies that affect the estimation of the economic costs of ADM in this study. The literature review draws heavily on the annotated bibliography. Chapter III presents the treatment costs of ADM in short-stay hospitals, including estimates of comorbidity costs. Also in Chapter III are other treatment and support costs, including the following cost categories: ADM specialty institutions, federal providers (Veterans Administration, Armed Services and Indian Health Service), nursing homes, office-based physicians and other professional services, drugs, and support costs. Sources of payment for direct core costs are presented. Estimates of morbidity costs, the value of reduced or lost productivity, are presented in Chapter IV. Chapter V discusses the mortality costs, productivity losses and years of life lost, for people who died in 1985 due to ADM disorders.

Other related ADM costs follow in Chapter VI. Included in this chapter are estimates of the direct costs of crime, motor vehicle crashes, fire destruction, and social welfare administration costs related to ADM. Also included are the value of productivity losses for the victims of crime, incarceration, crime careers, and family caregiving associated with ADM.

AIDS, fetal alcohol syndrome, and ADM illness among the homeless population are discussed in Chapter VII. Finally, Chapter VIII presents ADM cost estimates for 1988 and Chapter IX compares the 1985 costs herein with those for 1980 prepared by the Research Triangle Institute (RTI) in 1984 (Harwood et al., 1984). The main reasons for the differences are discussed.

MAGNITUDE OF ADM DISORDERS IN THE UNITED STATES

ADM disorders are costly to the nation in dollars, in pain and grief, in lives, and in reduced productivity. Substantial resources are used in the care and treatment of persons suffering from these disorders. The burden on public resources is large. This study examines and documents all of these dimensions of the problem. The estimates for many cost categories are based on data relating the use of medical resources, the prevalence of the disorders, and the number of deaths. Table 1 summarizes data scattered throughout this report providing the dimensions of the ADM problem that consumes a large share of U.S. medical resources.

The results from recent surveys also document the high prevalence of ADM disorders in the general population. Regier and associates (1988) reported one-month and lifetime prevalence of ADM disorders from the National Institute of Mental Health Epidemiologic Catchment Area (ECA) Program. Of the population 18 years of age and over, 15.4 percent fulfilled criteria for at least one alcohol, drug abuse, or other mental

Table 2

ECONOMIC COSTS OF ADM BY TYPE OF COST, 1985

Type of Cost	Amount (millions)			Percent Distribution				
	Total	Alcohol Abuse	Drug Abuse	Mental Illness	Total	Alcohol Abuse	Drug Abuse	Mental Illness
Total	\$218,081	\$70,338	\$44,052	\$103,691	100.0	100.0	100.0	100.0
Core Costs	167,993	58,181	10,624	99,188	77.0	82.7	24.1	95.7
Direct	51,420	6,810	2,082	42,528	23.6	9.7	4.7	41.0
Treatment Support	47,485	6,315	1,881	39,289	21.8	9.0	4.3	37.9
	3,935	495	201	3,239	1.8	0.7	0.4	3.1
Indirect	116,573	51,371	8,542	56,660	53.4	73.0	19.4	54.6
Morbidity Mortality*	80,762	27,388	5,979	47,395	37.0	38.9	13.6	45.7
	35,811	23,983	2,563	9,265	16.4	34.1	5.8	8.9
Other Related Costs	47,510	10,546	32,461	4,503	21.8	15.0	73.7	4.3
Direct	22,267	7,380	13,209	1,678	10.2	10.5	30.0	1.6
Indirect	25,243	3,166	19,252	2,825	11.6	4.5	43.7	2.7
Special Disease Groups	2,578	1,611	967	-	1.2	2.3	2.2	-
AIDS	967	-	967	-	-	-	2.2	-
Fetal Alcohol Syndrome	1,611	1,611	-	-	-	2.0	-	-

* 6 percent discount rate.

disorder during the one-month period before the interview and 32.2 percent during their lifetime.

The 1985 National Household Survey on Drug Abuse sponsored by the National Institute on Drug Abuse found that 62 million persons (32.4 percent of the population) used marijuana and hashish during their lifetime and 22.2 million (11.6 percent) used cocaine. Marijuana and hashish users during the year amounted to 29.4 million (15.3 percent), and 12.2 million (6.3 percent) used cocaine during the past year (National Institute on Drug Abuse, 1988).

The 1984 National Alcohol Survey conducted by the Alcohol Research Group under grant support from the National Institute of Alcohol Abuse and Alcoholism reported that 18 percent of all men and 5 percent of all women were classified as frequent drinkers; 6 percent of all male drinkers and 2 percent of all female drinkers reported they got drunk as often as once a week or more (Hilton, 1987).

TOTAL ECONOMIC IMPACT IN 1985

The economic cost to the nation of ADM disorders is measured in terms of the direct costs of diagnosis and treatment of patients suffering from these illnesses, indirect costs associated with loss of earnings due to reduced or lost productivity, premature death, and other related costs. The human capital approach used herein bases the value of productivity on market earnings and an imputed value for housekeeping services.

ADM imposes a multibillion dollar burden on the economy each year as highlighted below:

- Total economic costs of ADM amounted to \$218.1 billion in 1985 (Figure 1).
- The distribution by type of illness or disorder of total economic costs shows the greatest costs are for mental illness – \$103.7 billion, 48 percent; alcohol abuse – \$70.3 billion, 32 percent; drug abuse – \$44.1 billion, 20 percent (Figure 2).
- Direct treatment and support costs comprise 24 percent of the total; morbidity costs, the value of reduced or lost productivity, 37 percent; mortality costs, 16 percent, based on a 6-percent discount rate of the value of productivity forgone in future years as a result of premature mortality in 1985; and other related costs (including crime expenditures, motor vehicle crashes, fires, and the value of lost productivity for victims of crime, incarceration, crime careers, and caregivers), 22 percent (Table 2).
- The costs of acquired immunodeficiency syndrome (AIDS) associated with intravenous (IV) drug users and of fetal alcohol syndrome (FAS) amount to \$2.6 billion, or 1 percent of the total economic costs.
- Variation in the distribution by type of cost among the three disorders reflects differences in prevalence, medical care use,

Economic Costs of ADM by Type of Cost, 1985

Figure 1

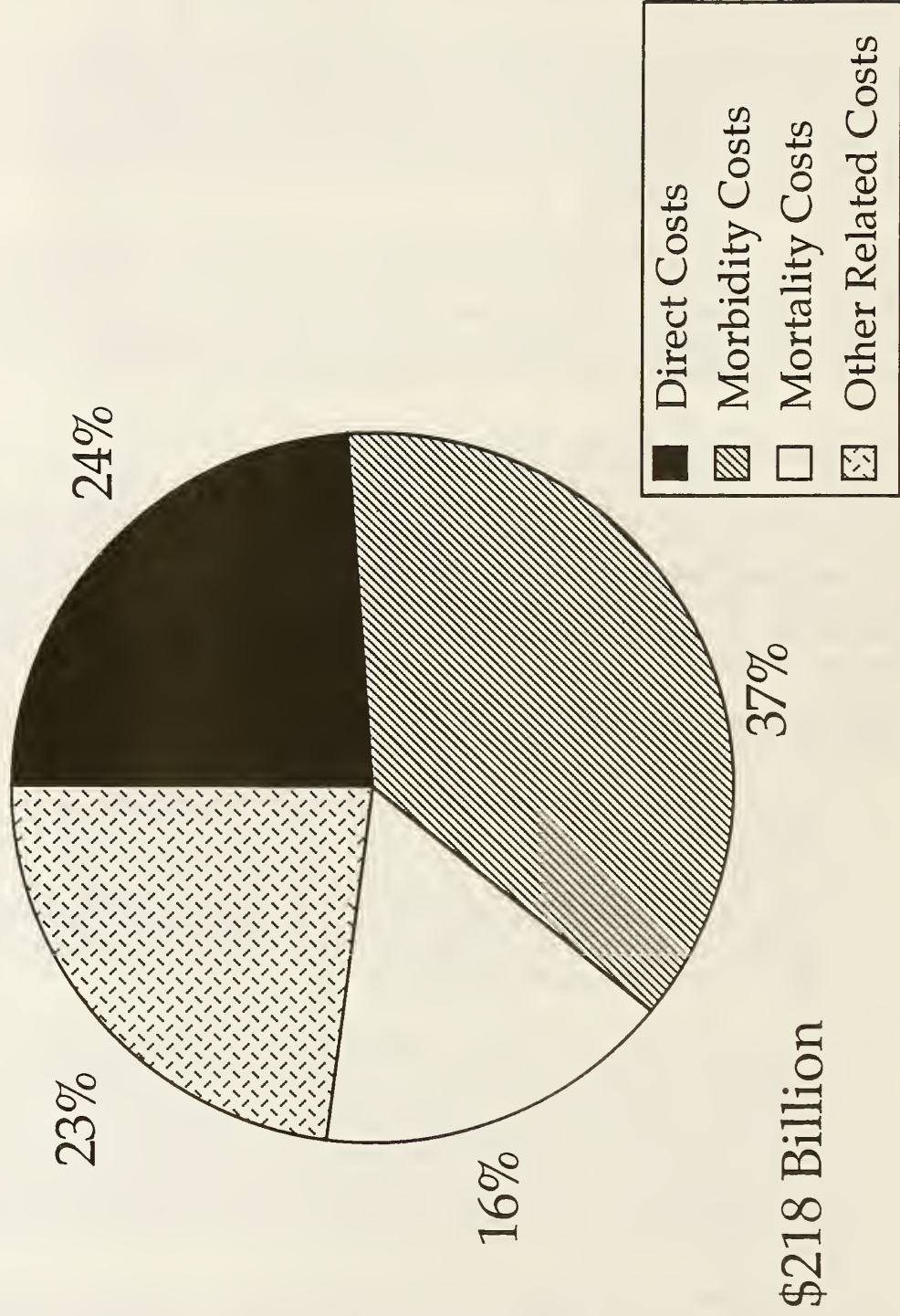


Figure 2

Economic Costs of ADM by Type of Disorder, 1985

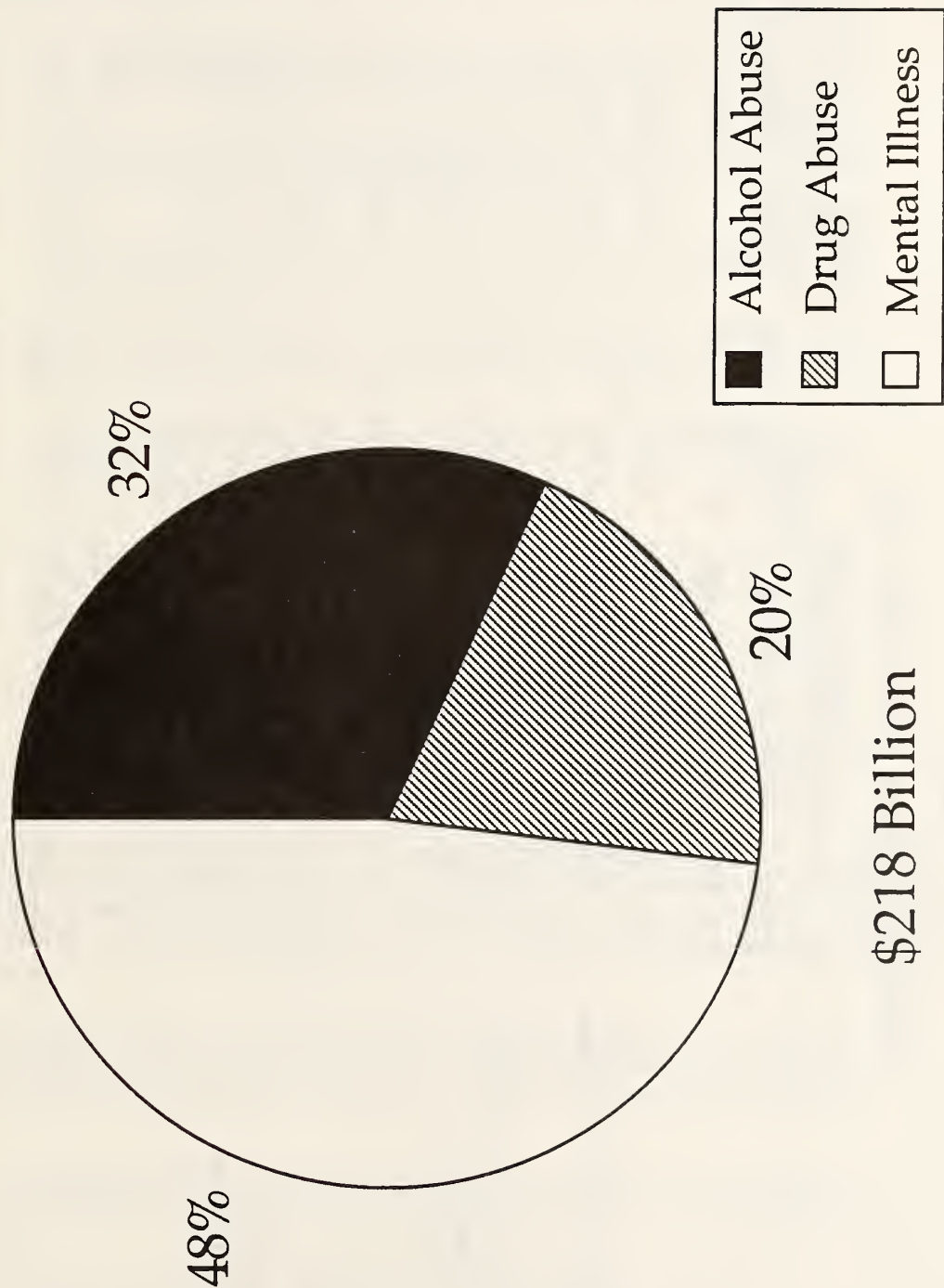


Table 3

CORE COSTS OF ADM BY TYPE OF COST, 1985

Type of Cost	Amount (millions)			Percent Distribution			
	Total	Alcohol Abuse	Drug Abuse	Mental Illness	Total		
					Alcohol Abuse	Drug Abuse	Mental Illness
Total	\$167,993	\$58,181	\$10,624	\$99,188	-	-	-
Direct Costs	51,420	6,810	2,082	42,528	100.0	100.0	100.0
ADM Specialty and Federal Institutions	15,682	2,281	570	12,831	30.5	27.4	30.2
Federal Providers	2,273	664	176	1,433	4.4	8.5	3.4
State & County Psychiatric Hospitals	5,661	215	91	5,355	11.0	4.4	12.6
Private Psychiatric Hospitals	1,888	72	30	1,786	3.7	1.4	4.2
Other ADM Institutions	5,860	1,330	273	4,257	11.4	13.1	10.0
Short-Stay Hospitals	13,064	3,017	1,242	8,805	25.4	59.7	20.7
Other Treatment Costs	18,739	1,017	69	17,653	36.4	3.3	41.5
Office-Based Physicians	2,344	141	52	2,151	4.6	2.1	5.1
Other Professional Services	3,656	173	17	3,466	7.1	0.8	8.1
Nursing Homes	11,286	703	-	10,583	22.0	10.3	24.9
Drugs	1,453	-	-	1,453	2.8	-	3.4
Support Costs	3,935	495	201	3,239	7.6	7.3	7.6
Indirect Costs	116,573	51,371	8,542	56,660	100.0	100.0	100.0
Morbidity	80,762	27,388	5,979	47,395	69.3	53.3	76.0
Noninstitutionalized Population	77,238	27,208	5,943	44,087	66.3	53.0	77.8
Institutionalized Population	3,524	180	36	3,308	3.0	0.3	5.8
Mortality*	35,811	23,983	2,563	9,265	30.7	46.7	16.4

* 6 percent discount rate.

morbidity and mortality patterns, and other related costs for each disorder (Figure 3):

- Of the \$70.3 billion for alcohol abuse, the greatest amount is for morbidity costs, \$27.4 billion or 39 percent.
- Of the total economic costs for drug abuse of \$44.1 billion, other related costs (including cost of AIDS) comprise the highest amount -- \$33.4 billion, or 76 percent.
- Morbidity costs account for almost half (46 percent) of the total \$103.7 billion cost for mental illness.
- The distribution by disorder of the total economic costs of ADM for each type of cost also shows considerable variation (Figure 4):
 - Mental illness comprises more than four-fifths (83 percent) of total ADM direct costs of \$51 billion; 13 percent is for alcohol abuse, and 4 percent is for drug abuse.
 - Of the total indirect costs of \$117 billion, 49 percent is for mental disorders, 44 percent for alcohol abuse, and 7 percent for drug abuse.
 - Drug abuse comprises the largest share, 68 percent, of other related costs; 22 percent is for alcohol abuse, and 10 percent for mental illness.

Core Costs

Core costs include all costs directly related to the treatment and support of persons with ADM disorders as well as the indirect costs associated with these disorders. Indirect costs are the value of lost output resulting from reduced productivity, lost work and housekeeping days, and losses due to premature death from ADM disorders.

- Core costs amount to \$168 billion for 1985, distributed as follows: \$99.2 billion, 59 percent, for mental illness; \$58.2 billion, 35 percent, for alcohol abuse; and \$10.6 billion, 6 percent, for drug abuse (Table 3).
- Core costs comprise more than three-fourths of the total economic costs of ADM. The remainder is for other related costs discussed below.
- Core costs account for the largest share of total mental illness costs (96 percent) and of total alcohol abuse costs (83 percent). Less than one-quarter (24 percent) of the drug abuse costs are core costs.
- The total core economic costs of ADM for men are twice that for women -- \$111 billion compared with \$57 billion (Table 4 and Figure 5). The significantly higher costs for men reflect their higher ADM prevalence, labor force participation rates, and earnings than for women.

Figure 3

Economic Costs of Alcohol Abuse, Drug Abuse & Mental Illness by Type of Cost, 1985

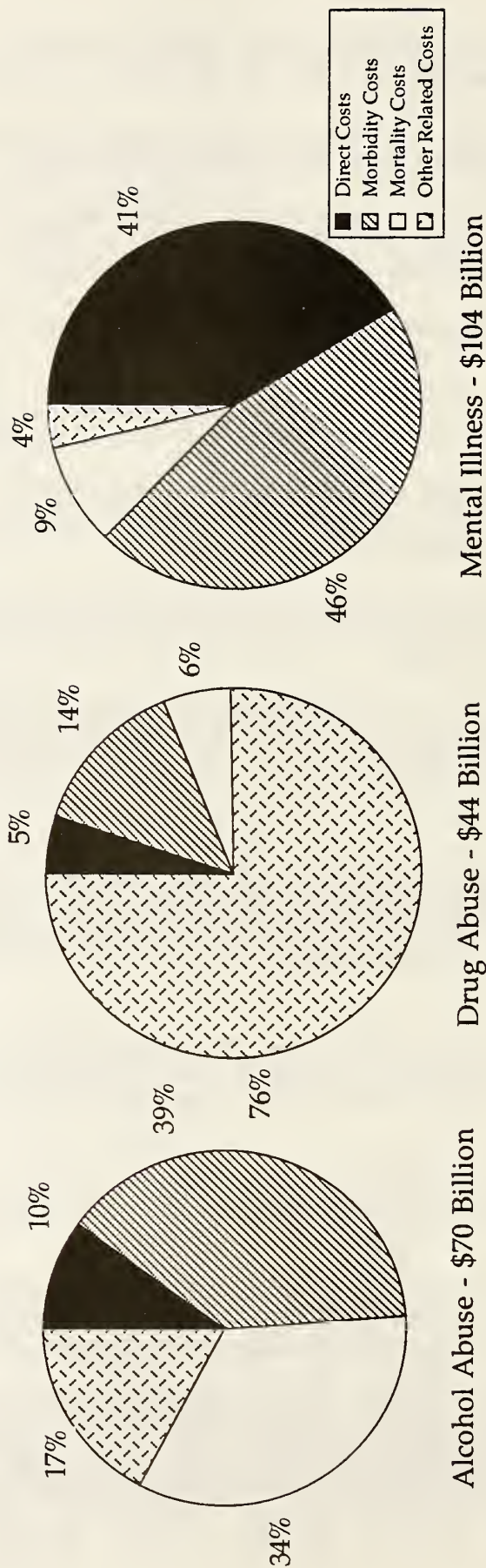


Figure 4

Economic Costs of ADM by Type of Cost and Disorder, 1985

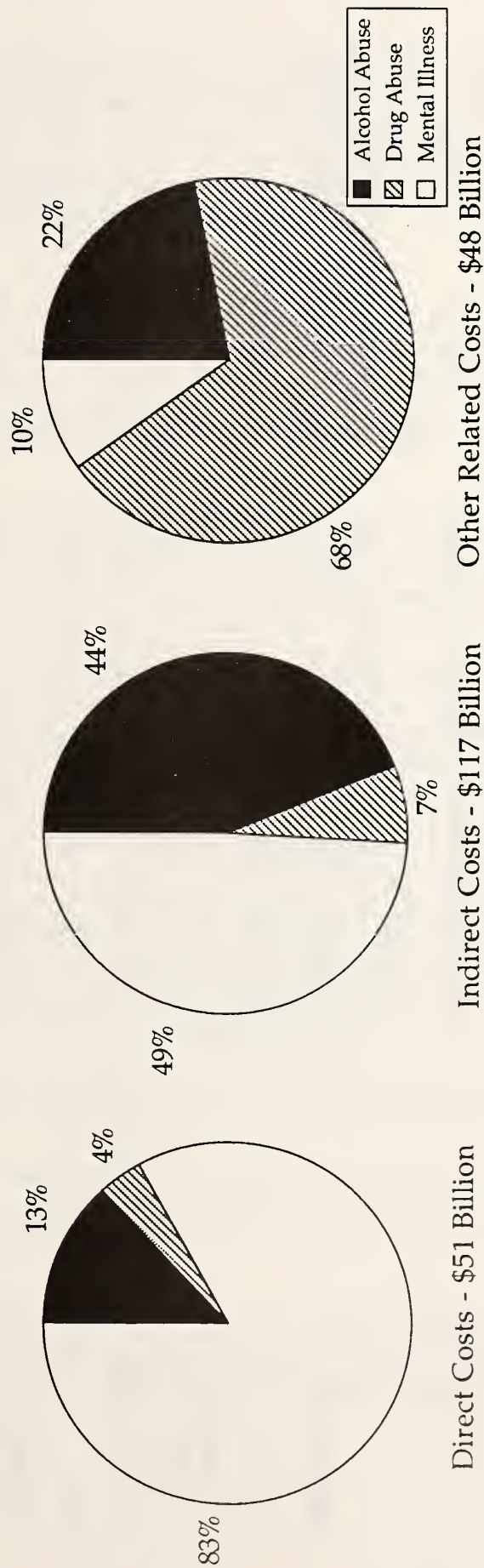


Table 4

CORE COSTS OF ADM BY AGE AND SEX, 1985

Age and Sex	Amount (millions)			Percent Distribution				
	Total	Alcohol	Drug	Mental Illness	Total	Alcohol Abuse	Drug Abuse	Mental Illness
		Abuse	Abuse					
Total	\$167,993	\$58,181	\$10,624	\$99,188	100.0	100.0	100.0	100.0
Under 15*	2,996	796	98	2,102	1.8	1.4	0.9	2.1
15-44	91,904	34,934	7,216	49,754	54.7	60.0	67.9	50.2
45-64	53,065	19,997	3,015	30,053	31.6	34.4	28.4	30.3
65 and Over	20,026	2,455	295	17,276	11.9	4.2	2.8	17.4
Male	111,019	46,995	6,953	57,071	100.0	100.0	100.0	100.0
Under 15*	1,891	539	57	1,295	1.7	1.1	0.8	2.3
15-44	66,211	28,767	4,977	32,467	59.6	61.2	71.6	56.9
45-64	35,802	16,352	1,792	17,658	32.2	34.8	25.8	30.9
65 and Over	7,115	1,337	127	5,651	6.4	2.8	1.8	9.9
Female	56,973	11,186	3,671	42,116	100.0	100.0	100.0	100.0
Under 15*	1,105	257	41	807	1.9	2.3	1.1	1.9
15-44	25,693	6,167	2,239	17,287	45.1	55.1	61.0	41.1
45-64	17,263	3,645	1,223	12,395	30.3	32.6	33.3	29.4
65 and Over	12,911	1,118	168	11,625	22.7	10.0	4.5	27.6

* The under-15 age group includes costs for 15-17 year old persons for several cost categories (including ADM specialty institutions and federal providers); thus, the costs for the under-15 age group are overstated and the costs for the 15-44 age group are correspondingly understated.

- The 15-44 age group accounts for the largest share of core costs, 55 percent, followed by the 45-64 age group, which accounts for 32 percent of the total (Figure 6). For drug abuse and alcohol abuse, 68 percent and 60 percent, respectively, of the costs are for the 15-44 age group, reflecting the high prevalence of drug and alcohol abuse and the large number of deaths in this age group.

Direct Costs

Direct costs include the amounts spent in 1985 for personal health care for persons suffering from ADM disorders, including hospital and nursing home care, physician and other professional services, and prescription drugs. Also included are support costs related to the treatment of ADM disorders, such as expenditures for research, training costs for physicians and nurses, program administration, and net cost of private insurance.

- Direct expenditures for medical treatment and support for all ADM disorders amount to \$51.4 billion, 24 percent of the total ADM economic costs. Of this total, care of the mentally ill comprises more than four-fifths due to the high prevalence of mental illness requiring hospital, medical, and institutional care.
- Of the total \$51.4 billion, 31 percent is spent by federal providers and ADM specialty institutions, such as state, county, and private psychiatric hospitals, residential treatment centers, freestanding facilities, alcohol and drug treatment units, and other specialized treatment centers.
- Expenditures for care of ADM patients in short-stay hospitals amount to \$13.1 billion, one-quarter of total direct costs. Of the \$13.1 billion, \$10.2 billion is the cost of care for 1.9 million discharges using 22.1 million days of care associated with a primary ADM diagnosis. The remaining \$2.9 billion is the estimated comorbidity cost for the 2.2 million discharges with a secondary ADM diagnosis. On the average, these patients stayed 2.84 days longer than those without ADM diagnoses.
- Nursing home expenditures, mainly for persons suffering from mental disorders, amount to \$11.3 billion, 22 percent of direct costs.
- Support costs, including expenditures for research, training costs of physicians and nurses, program administration, and the net cost of private health insurance are estimated at \$3.9 billion, 8 percent of direct costs.
- Private sources account for 44 percent of the total direct expenditures for treatment and support of persons with ADM disorders; 56 percent is borne by public sources, equally divided between federal and state and local sources (Table 5 and Figure 7).

Figure 5

Economic Core Costs of ADM by Sex, 1985

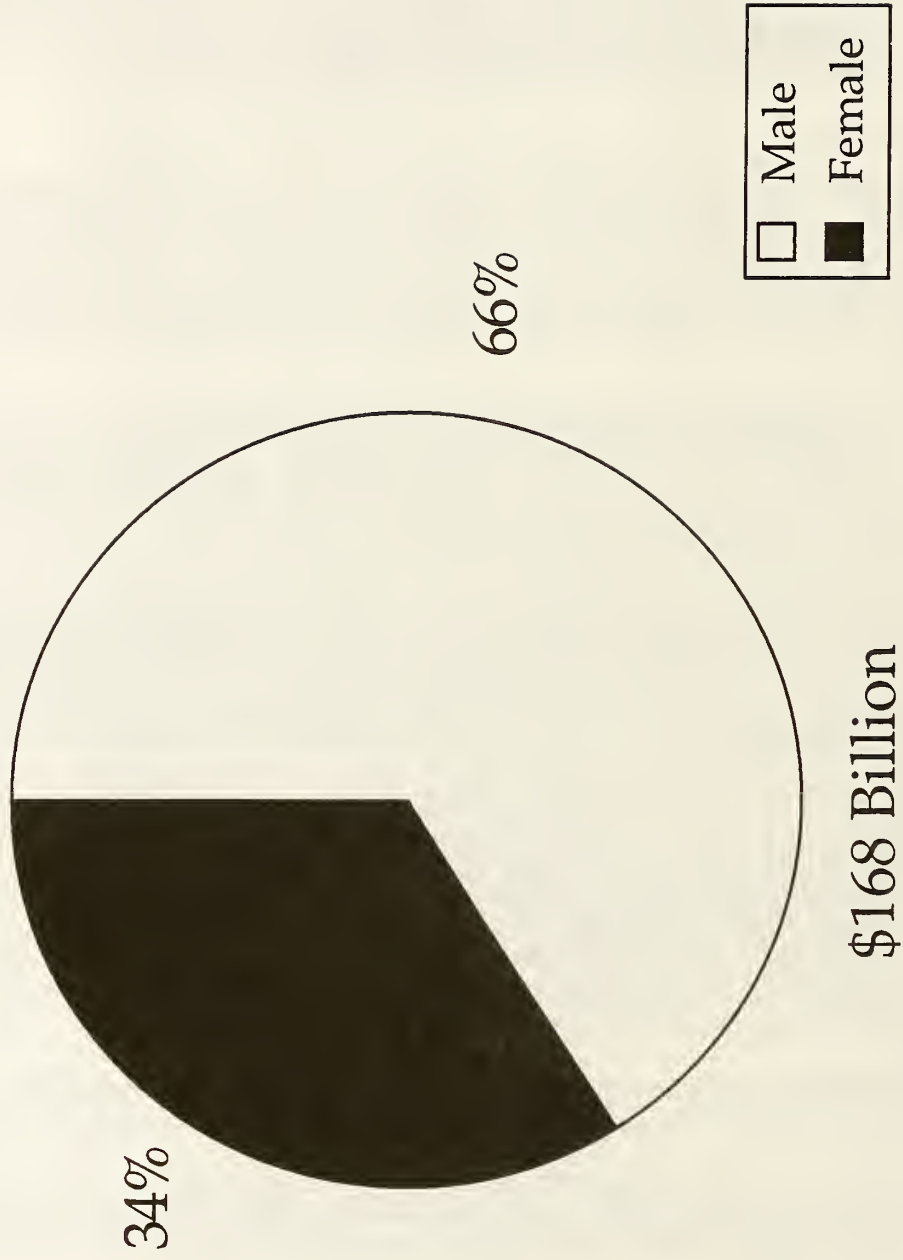
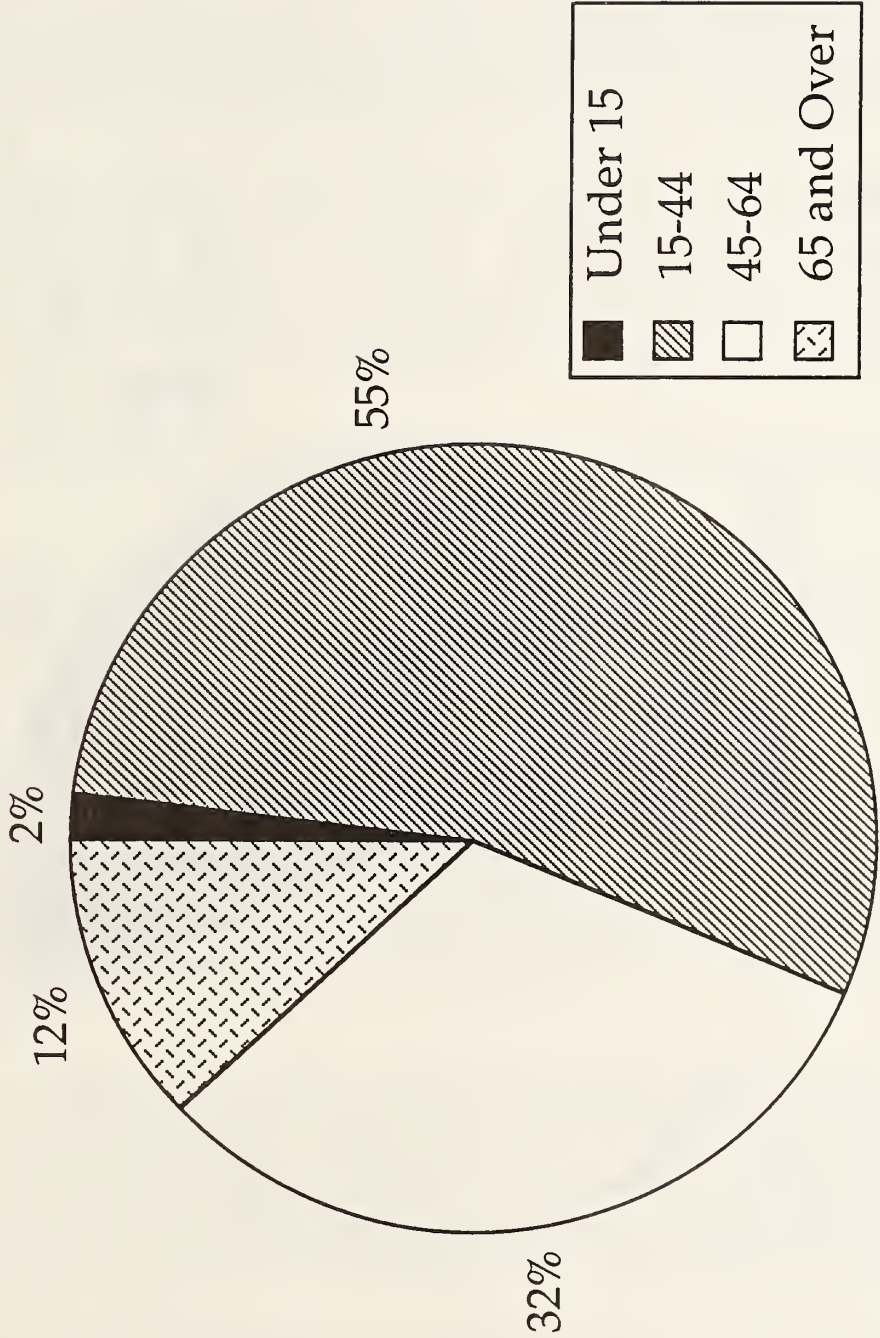


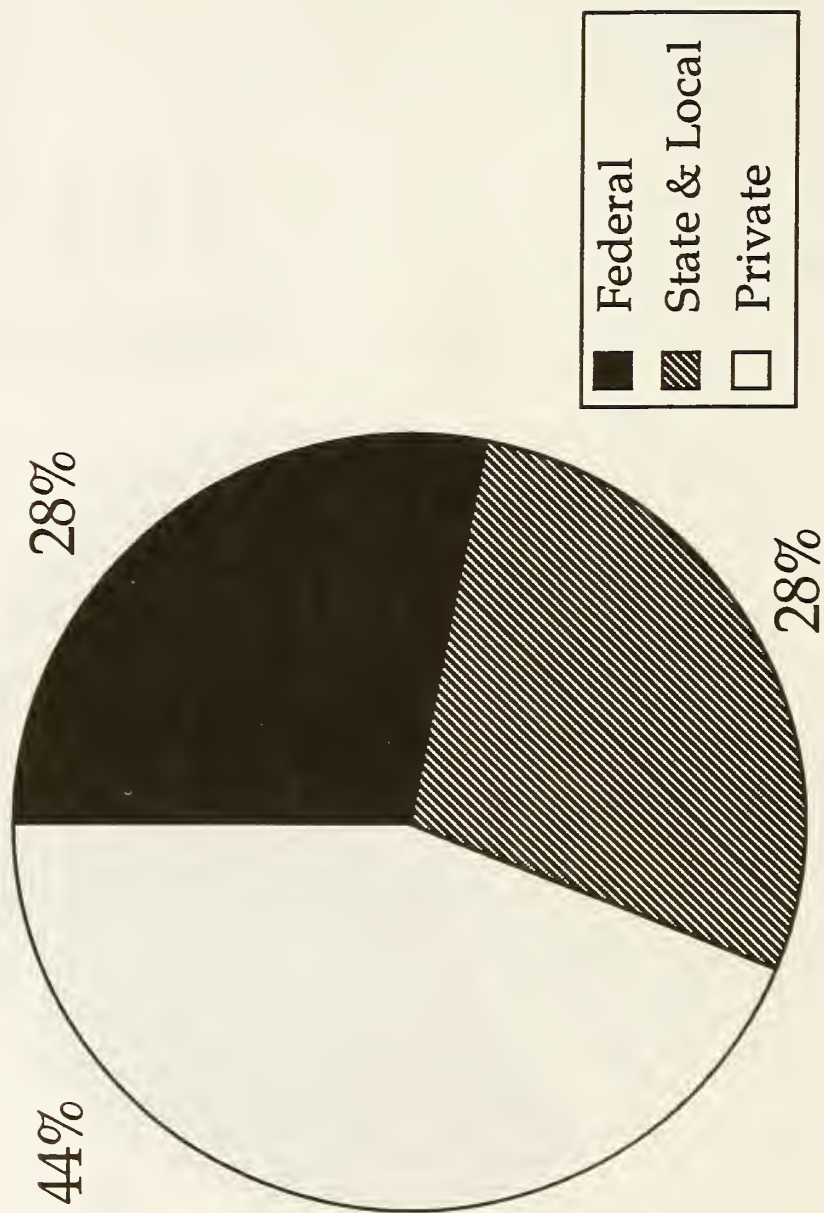
Figure 6

Economic Core Costs of ADM by Age, 1985



\$168 Billion

ADM Core Direct Costs by Source of Payment, 1985



\$51.4 Billion

Morbidity Costs

Morbidity costs are the value of goods and services not produced in 1985 because of ADM disorders. Included are the value of reduced and lost productivity for the total civilian population suffering from ADM disorders. To the degree that ADM disorders prevent or deter people from producing goods and services in the marketplace, in the public sector, or in their homes, the value of morbidity losses is a cost borne by society.

For the noninstitutionalized population, morbidity costs involve estimation of impairment rates due to ADM disorders and application of average income lost per individual to the prevalence of ADM disorders. Income includes earnings in the marketplace and an imputed dollar value for housekeeping services. Regression analysis is employed to estimate impairment rates based on a model that measures the lifetime effect on current income of individuals with these disorders, taking into account the timing and duration of ADM disorders.

For the institutionalized population, morbidity costs involve applying average earnings to work years lost and to the value of housekeeping services for those unable to perform them.

- Total morbidity costs amount to \$80.8 billion for 1985 distributed as follows: mental illness -- \$47.4 billion, 59 percent; alcohol abuse -- \$27.4 billion, 34 percent; and drug abuse -- \$6.0 billion, 7 percent.
- Costs for the noninstitutionalized population amount to \$77.2 billion and account for 96 percent of the total morbidity costs.
- For the institutionalized population, morbidity costs amount to \$3.5 billion. Costs for persons with mental illness comprise 94 percent of the total. This high proportion is accounted for by the larger number of residents with mental disorders in mental hospitals and in nursing homes compared with persons institutionalized for the other two disorders.

Mortality Costs

Mortality costs are the present value of lifetime earnings lost by all who died in 1985 due to ADM disorders. This cost is the product of the number of ADM deaths and the expected value of future earnings with gender and age taken into account. This method takes into consideration life expectancy at the age of death, changing patterns of earnings at successive ages, varying labor force participation rates, imputed value for housekeeping services, and a 6 percent discount rate to convert aggregate earnings over a lifetime to its present worth.

- In 1985, 140,593 people died from ADM disorders -- 94,765 alcohol abuse deaths, 39,707 mental illness deaths, and 6,118 drug abuse deaths (Table 6). Included are all deaths for which the underlying cause is coded as alcohol abuse, drug abuse, or mental illness. For alcohol abuse, alcohol-related deaths are included in which alcohol is implicated as a contributing cause of death. For example, about half the deaths due to motor vehicle traffic accidents, two-fifths of deaths from falls and fires and burns, and three-tenths of drownings are estimated to involve alcohol. Almost all suicides (87

Table 5

CORE DIRECT COSTS OF ADM BY TREATMENT SETTING AND SOURCE OF PAYMENT, 1985

Treatment Setting	Amount (millions)			Percent Distribution				
	State &			Private[1]	State &			Private[1]
	Total	Federal	Local		Total	Federal	Local	
Total	\$51,420	\$14,365	\$14,576	\$22,479	100.0	27.9	28.4	43.7
ADM Specialty and Federal Institutions	15,682	4,229	9,520	1,933	100.0	27.0	60.7	12.3
Federal Providers	2,273	2,273	-	-	100.0	100.0	-	-
State & County Psychiatric Hospitals	5,661	821	4,585	255	100.0	14.5	81.0	4.5
Private Psychiatric Hospitals	1,888	285	189	1,414	100.0	15.1	10.0	74.9
Other ADM Institutions	5,860	850	4,746	264	100.0	14.5	81.0	4.5
Other Treatment Costs	31,803	8,888	4,754	18,161	100.0	27.9	15.0	57.1
Short-Stay Hospitals	13,064	5,304	2,123	5,637	100.0	40.6	16.3	43.1
Office-Based Physicians	2,344	165	59	2,120	100.0	7.0	2.5	90.5
Other Professional Services	3,656	256	91	3,309	100.0	7.0	2.5	90.5
Nursing Homes	11,286	3,092	2,404	5,790	100.0	27.4	21.3	51.3
Drugs	1,453	71	77	1,305	100.0	4.9	5.3	89.8
Support Costs	3,935	1,248	302	2,385	100.0	31.7	7.7	60.6

[1] Includes private health insurance, direct payments by patients, and philanthropy.

Table 6

MORTALITY LOSSES OF ADM BY AGE, 1985

Age	Amount			Percent Distribution				
	Total	Alcohol Abuse	Drug Abuse	Mental Illness	Total	Alcohol Abuse	Drug Abuse	Mental Illness
Number of Deaths								
Under 15	140,593	94,765	6,118	39,707	100.0	100.0	100.0	100.0
15-44	4,055	2,675	61	1,319	2.9	2.8	1.0	3.3
45-64	53,150	34,192	4,568	14,390	37.8	36.1	74.7	36.2
65 and Over	34,640	26,981	865	6,794	24.6	28.5	14.1	17.1
	48,745	30,916	624	17,205	34.7	32.6	10.2	43.3
Person Years Lost (thousands)								
Under 15	3,955	2,675	231	1,049	100.0	100.0	100.0	100.0
15-44	283	184	4	95	7.1	6.9	1.7	9.1
45-64	2,424	1,571	199	654	61.3	58.7	86.1	62.3
65 and Over	791	610	22	158	20.0	22.8	9.5	15.1
	457	309	6	142	11.6	11.6	2.6	13.5
Mortality Costs * (millions)								
Under 15	\$35,811	\$23,983	\$2,563	\$9,265	100.0	100.0	100.0	100.0
15-44	1,031	712	14	305	2.9	3.0	0.5	3.3
45-64	26,543	16,981	2,326	7,236	74.1	70.8	90.8	78.1
65 and Over	7,400	5,667	209	1,524	20.7	23.6	8.2	16.4
	837	624	13	201	2.3	2.6	0.5	2.2

* 6 percent discount rate.

Table 7

OTHER RELATED COSTS OF ADM BY TYPE OF COST, 1985

Type of Cost	Amount (millions)			Percent Distribution			
	Total	Alcohol Abuse		Total	Alcohol Abuse		Mental Illness
		Abuse	Drug Abuse		Abuse	Drug Abuse	
Total	\$47,510	\$10,546	\$32,461	\$4,503	100.0	100.0	100.0
Direct Costs	22,267	7,380	13,209	1,678	46.9	40.7	37.3
Crime Expenditures	18,755	4,251	13,203	1,301	39.5	40.3	28.9
Public	15,765	3,734	11,063	968	33.2	35.4	21.5
Private Legal Defense	2,056	342	1,381	333	4.3	3.2	7.4
Property Destruction	934	175	759	-	2.0	1.7	-
Other Direct Expenditures	3,512	3,129	6	377	7.4	29.7	8.4
Motor Vehicle Crashes	2,584	2,584	-	-	5.4	24.5	-
Fire Destruction	457	457	-	-	1.0	4.3	-
Social Welfare Administration	471	88	6	377	1.0	.8	8.4
Indirect Costs	25,243	3,166	19,252	2,825	53.1	30.0	62.7
Victims of Crime	1,307	465	842	-	2.7	4.4	-
Incarceration	7,460	2,701	4,434	325	15.7	25.6	7.2
Crime Careers	13,976	-	13,976	-	29.4	-	-
Family Caregiving	2,500	-	-	2,500	5.3	-	55.5

* Less than 0.05 percent.

percent) are classified as mental illness suicides; the remaining 13 percent are classified as alcohol-related deaths.

- These 140,593 deaths result in almost 4 million person years lost, or 28 years per death. These deaths represent a loss of \$35.8 billion to the economy at a 6 percent discount rate, or \$254,716 per death.
- For the 94,984 men who died from ADM disorders, an estimated 2.8 million person years are lost, 29 years per death, valued at \$28.6 billion, or \$301,566 per death. The 45,608 women who died represent a loss of 1.2 million years, or 26 years per death. Because of the fewer deaths and lower earnings of women, losses are significantly lower than for men, amounting to a total of \$7.2 billion, or \$157,145 per death. Thus, men account for 68 percent of the ADM deaths, 70 percent of the person years lost, and 80 percent of the productivity losses for 1985.
- Many people who die of ADM disorders are relatively young -- 38 percent of the victims are aged 15-44. The total of life years lost for this age group, a function of both age and number of deaths, represents 61 percent of the person years lost to ADM disorders. In terms of lost earnings, this age group accounts for 74 percent of the total. By contrast, 35 percent of ADM deaths are persons 65 years and over, accounting for 12 percent of person years lost and only 2 percent of productivity losses.
- ADM deaths comprise 7 percent of the 2.1 million deaths in the United States in 1985, 12 percent of the total person years lost and 20 percent of the total productivity losses.
- ADM deaths comprise a disproportionately larger share of deaths at the younger age groups. Almost half, 46 percent, of all ADM deaths are aged 15-24 years, and 30 percent are aged 25-44.

Other Related Costs

Other related costs include costs indirectly related to the treatment and lost productivity of persons with ADM disorders. They include direct costs of crime, motor vehicle crashes, social welfare program administrative costs, and costs associated with the destruction of property by fire. Indirect costs include the value of productivity losses for victims of crime, incarceration, crime careers, and time spent to care for family members because of their mental illness.

- Other related direct and indirect costs are estimated at \$47.5 billion for 1985. Of this total, direct costs account for \$22.3 billion (47 percent) and indirect costs for the remaining \$25.2 billion (53 percent) (Table 7).
- Drug abuse costs comprise the largest share of the total other related costs -- \$32.5 billion, or 68 percent. Alcohol abuse costs are \$10.5 billion (22 percent), and mental illness costs amount to \$4.5 billion (9 percent).

- Of the \$22.3 billion in other related direct costs, 84 percent is related to crime. The remaining 16 percent includes the value of losses due to motor vehicle crashes, fire destruction, and social welfare program administration costs associated with ADM.
- The \$25.2 billion in other related indirect costs is distributed as follows: \$1.3 billion in lost work time by victims of crime; \$7.5 billion in productivity losses for persons incarcerated in prisons as a result of conviction for ADM-related crimes; \$14 billion in estimated losses for those who engage in crime as a career rather than legal employment; and \$2.5 billion as the value of time spent to care for family members because of their mental illness.

ECONOMIC COSTS OF ALCOHOL ABUSE

Alcohol dependency and abuse is a major public health problem in the United States. Alcohol abuse generates a large demand on the health care system and the value of their reduced or lost productivity is high, as summarized below.

- Alcohol abuse cost the nation \$70.3 billion in 1985; for 1988, the total is estimated at \$85.8 billion.
- Direct costs of alcohol abuse amount to \$6.8 billion, 10 percent of the total costs for 1985.
- Morbidity costs, the value of reduced or lost productivity, amount to \$27.4 billion, 39 percent of the total. These costs are based on an estimated alcohol abuse prevalence rate of 14.9 percent of the civilian noninstitutionalized population aged 18 to 64, or 21.5 million persons, and 44,325 residents of mental facilities and nursing homes suffering from this disorder. Alcohol abuse prevalence is a diagnostic measure, defined in terms of clinical criteria for a medical diagnosis.
- Almost 95,000 deaths occurred in 1985 due to alcoholism. Of this total, less than one-fifth are deaths for which alcoholism was the main cause of death. The remaining four-fifths are alcohol-related deaths. These 95,000 deaths represent 2.7 million person years lost, or 28.2 years per death and a loss of \$24.0 billion to the economy at a 6 percent discount rate, or \$253,071 per death.
- Core costs (direct and indirect health-related costs) account for \$58.2 billion. Adults aged 15-44 account for three-fifths of the total core costs. The cost for men is more than four times that for women -- \$47.0 billion compared with \$11.2 billion.
- Other related alcohol abuse costs amount to \$10.5 billion, 15 percent of the total economic costs. The largest cost component is crime expenditures, amounting to \$4.3 billion, two-fifths of the other related costs. The value of motor vehicle crashes due to alcoholism is also high, amounting to \$2.6 billion.

- The value of lost productivity for victims of crime due to alcohol abuse amount to almost \$500 million, and productivity losses for those who are incarcerated in prisons amount to \$2.7 billion.
- Fetal alcohol syndrome is recognized as a serious disorder with physical and mental deficiencies that are costly to treat and rehabilitate and require long-term care services. For 1985, total costs of fetal alcohol syndrome amount to \$1.6 billion. The largest proportion of these costs, \$1.3 billion or 80 percent, is spent for residential care and support services for mentally retarded persons over age 21 impaired by the disorder. Neonatal intensive care costs of treating growth retardation amount to \$118 million, and \$110 million is spent for full-time residential care for severely mentally retarded persons under age 21.

ECONOMIC COSTS OF DRUG ABUSE

Drug abuse and drug addiction are costly to the nation in medical resources used for care, treatment, and rehabilitation; in reduced and lost productivity; in crime enforcement; and in pain and suffering of drug abusers, their families and friends. The emergence of AIDS among intravenous drug users is a major public health problem in the United States. The 1985 costs to society of drugs are summarized below. Crack cocaine addiction and its devastating consequences are not included in the cost estimates because this major public health problem emerged after 1985.

- The total economic costs of drug abuse amounted to \$44.1 billion in 1985, including direct treatment and support costs (5 percent), indirect morbidity costs (14 percent), mortality costs (6 percent), other related costs (74 percent), and the cost of AIDS (2 percent).
- The total cost of drug abuse is estimated at \$58.3 billion for 1988.
- Direct costs of drug abuse amount to \$2.1 billion for 1985. Of this total, three-fifths are for care of persons in short-stay hospitals with primary and secondary diagnoses of drug abuse.
- Drug abuse morbidity costs, the value of reduced or lost productivity, amount to \$6 billion based on a prevalence rate of 3.6 percent among adults aged 18 to 64, or 5.2 million persons, and 1,775 residents in mental facilities suffering from this disorder. Prevalence is based on a diagnostic measure, defined in terms of clinical criteria for a medical diagnosis of drug abuse or dependence. People who use marijuana, hashish, cocaine, and other illicit drugs without clinical manifestations of drug abuse or dependence and without meeting severity criteria are not included here.
- More than 6,100 deaths in 1985 are attributed to drug abuse, representing 231,000 person years lost, or 37.8 years per death and a loss of \$2.6 billion to the economy at a 6 percent discount rate, or \$418,857 per death.

- About three-fourths of the drug abuse deaths occur among persons aged 15 to 44 years. This age group accounts for 86 percent of the person years lost and 91 percent of the mortality costs of drug abuse.
- Core costs (direct and indirect health-related costs) account for \$10.6 billion. Adults aged 15-44 account for two-thirds of the total core costs. The cost for men is almost twice that for women -- \$6.9 billion compared with \$3.7 billion.
- The major cost component for drug abuse is other related costs, amounting to \$32.5 billion and comprising almost three-fourths of the total economic costs of drug abuse. Direct crime expenditures amount to \$13.2 billion, two-fifths of the other related costs. Crime expenditures include public police protection costs, private legal defense, and property destruction.
- Other related costs also include the value of productivity losses for those who, as a result of heroin or cocaine addiction, engage in crime as a career rather than in legal employment. These productivity losses are estimated at \$14 billion. In addition, the productivity losses of people incarcerated in prisons as a result of conviction of a drug-related crime are estimated at \$4.4 billion.
- The direct and indirect costs of AIDS associated with intravenous drug users is estimated at almost \$1 billion. Of this total, indirect costs comprise four-fifths of the total, mainly due to high mortality among persons with AIDS.

ECONOMIC COSTS OF MENTAL ILLNESS

Mental illness comprises a wide range of mental disorders, including psychoses, neuroses, schizophrenia, personality disorders, organic brain syndrome, depression, and others. People who commit suicide are classified as having mental disorders. The prevalence of mental disorders is high. The Epidemiologic Catchment Area (ECA) surveys report that almost one-third of the population 18 years of age and over have a mental disorder during their lifetime (Regier et al., 1988). This high prevalence results in high use of medical care services and considerable costs to society in productivity losses, as summarized below.

- Mental illness imposed a \$103.7 billion burden on the U.S. economy in 1985. For 1988, the total economic cost of mental illness is estimated at \$129.3 billion.
- Mental illness costs for men are more than one-third higher than for women -- \$57.1 billion compared to \$42.1 billion.
- Direct costs of mental illness amount to \$42.5 billion, 41 percent of the total costs for 1985.
 - About 30 percent of the direct costs are expenditures for a) care in specialty institutions (state, county, and psychiatric hospitals, residential treatment centers for emotionally

disturbed children, freestanding mental health care centers, and correctional facilities); and b) care given by federal providers (Veterans Administration, Army, Navy, Air Force, and Indian Health Affairs).

- More than 20 percent, \$8.8 billion, is spent for short-stay hospital care, of which \$7.0 billion is the cost of care for 1.1 million discharges using 15.2 million days of care associated with a primary mental illness diagnosis. The remaining \$1.8 billion is the estimated comorbidity cost for the 1.5 million discharges with a secondary mental illness diagnosis. These patients stayed an average of 3.4 days longer than those without a mental illness diagnosis.
- Nursing home expenditures for the mentally ill amount to \$10.6 billion, 25 percent of direct costs.
- Prescription drugs for the mentally ill are estimated at \$1.5 billion, 3 percent of the direct costs.
- Mental illness morbidity costs, the value of reduced or lost productivity, amount to \$47.4 billion, 46 percent of the total \$103.7 billion. Morbidity costs are based on an estimated prevalence of 27.7 million persons with affective disorders, 25.3 million persons with anxiety disorders, 8.8 million persons with anti-social personality disorders, 2.6 million persons with schizophrenia, 489,000 persons with cognitive impairments, and 281,000 persons suffering from somatization. These prevalence numbers are based on the Epidemiologic Catchment Area (ECA) surveys and are measured by the number of individuals who satisfy criteria of the DSM-III or DSM-III-R classification system for psychiatric diagnoses.
- A total of 39,707 deaths due to mental disorders occurred in 1985, representing more than one million person years lost, or 26.4 years per death and a loss of \$9.3 billion to the economy at a 6 percent discount rate, or \$233,337 per death.
- More than two-fifths of the deaths due to mental illness among persons aged 65 years and over. Due to the short life expectancy and low earnings of that age group, person years lost amount to 14 percent of total person years lost and mortality costs comprise only 2 percent of the total mortality costs. By contrast, 36 percent of the mental illness deaths are among persons aged 15-44, accounting for 62 percent of person years lost and 78 percent of productivity losses.
- Core costs (direct and indirect health-related costs) account for \$99.2 billion. Adults aged 15-44 account for half the total core costs. About 30 percent of the cost is for people aged 45 to 64, and 17 percent for those 65 years and over.
- Other related costs amount to \$4.5 billion and comprise 4 percent of the total economic costs of mental illness. The largest component is

Table 8

ESTIMATED ECONOMIC COSTS OF AID BY TYPE OF COST, 1988
(millions)

Type of Cost	Total	Alcohol Abuse	Drug Abuse	Mental Illness
Total	\$273,333	\$85,790	\$58,279	\$129,264
Core Costs	206,506	70,184	12,896	123,426
Direct	66,774	8,729	2,656	55,389
Treatment Support	61,956	8,126	2,407	51,423
	4,818	603	249	3,966
Indirect	139,732	61,455	10,240	68,037
Morbidity Mortality*	97,173	32,953	7,194	57,026
	42,559	28,502	3,046	11,011
Other Related Costs	61,809	13,769	42,202	5,838
Direct	28,479	9,589	16,782	2,108
Indirect	33,330	4,180	25,420	3,730
Special Disease Groups	5,018	1,837	3,181	-
AIDS	3,181	-	3,181	-
Fetal Alcohol Syndrome	1,837	1,837	-	-

* 6 percent discount rate.

the value of time spent by caregivers providing care to mentally ill family members, amounting to \$2.5 billion. The next largest amount is spending for crime associated with mental illness, amounting to \$1.3 billion. Included are criminal justice system costs of police protection, and federal, state, and local correctional institutions.

1988 ESTIMATES

- The total economic cost of ADM in 1988 is estimated at \$273.3 billion using a variety of indexes to project 1985 costs (Table 8).
- The distribution of total 1988 disorders by type is: mental illness -- \$129.3 billion, 47 percent; alcohol abuse -- \$85.8 billion, 31 percent; and drug abuse -- \$58.3 billion, 21 percent.

COMPARISON WITH PREVIOUS COST ESTIMATES

One of the objectives of the present study, conducted at the University of California, San Francisco (UCSF), is to update to 1985 the 1980 ADM cost estimates made by the Research Triangle Institute (RTI). An update of costs from 1980 to 1985 would be expected to encompass a rise due to inflation and to reflect changes in the prevalence of these disorders. With no changes in prevalence or in estimating methodology, direct expenditures for ADM disorders might increase about 72 percent, the rise in national health expenditures during the 5-year period, 1980-1985. Indirect costs might be expected to increase about 45 percent, the growth in total earnings during this period. In fact, the total in 1985 was 14 percent higher than the 1980 estimate; direct treatment and support expenditures were 45 percent higher, morbidity costs 21 percent lower, mortality costs 52 percent higher, and other related costs 63 percent higher. Comparisons by type of disorder show that alcohol abuse costs were 21 percent lower, drug abuse costs 6 percent lower, and mental illness costs 91 percent higher. UCSF estimates differ from RTI results mainly because of the use of new sources of data and different estimation methods highlighted below.

Direct Treatment and Support Costs

UCSF estimates for 1985 are 44 percent higher than the RTI 1980 estimates, but two types of expenditures (office-based physicians and drugs) are lower. The main reason for this difference is the use by UCSF of a direct method of estimation based on new and current surveys in which data on ADM use of specific services were used as a basis for estimating costs. RTI employed an indirect cost estimation methodology that involved estimation of the ADM use of specific medical care services as a percentage of total use and the application of these proportions to the total expenditures reported in the National Health Accounts for each cost category. RTI also made estimates of alcohol-related direct costs based on proportions of the illnesses or diseases that were deemed to be ADM-related. UCSF developed a comorbidity methodology for short-stay hospitals that identified the additional days of care for patients with secondary ADM diagnoses for all patients with non-ADM primary diagnoses and applied cost per patient day. For ambulatory and nursing home care, UCSF used all ADM diagnoses, whether primary or secondary. The UCSF approach employs all documented primary and secondary ADM diagnoses; when these diagnoses are underreported, the cost estimates are underreported.

Morbidity Costs

Total ADM morbidity costs for 1985 (UCSF estimates) are 21 percent less than those estimated for 1980 (RTI estimates), despite growth in total earnings of 45 percent during this period. There are substantial differences by disorder: alcohol abuse costs are 50 percent lower, drug abuse costs are 77 percent lower, and mental illness costs are 119 percent higher. The UCSF calculations of reduced productivity are based on estimates of prevalence and income losses of all three disorders from the Epidemiologic Catchment Area (ECA) Program. The ECA surveys provide separate but mutually consistent estimates of morbidity costs for each of the ADM disorder groups. The model used measures lifetime effect on income of individuals with these disorders, taking into account the time and duration of ADM disorders. The RTI estimates were based on two surveys: the National Alcohol Survey (NAS) and the National Household Survey on Drug Abuse (NHSDA). No data source was available for estimates of reduced productivity for mental illness. Instead, mental illness morbidity cost estimates were based on imputations of loss due to partial and total disability. The ECA surveys produce clinical diagnostic (DSM-III) prevalence measures, whereas the NAS and NHSDA household surveys produce prevalence measures based on substance-related problem behavior or measures of quantity and frequency of consumption. Finally, different specifications of the income loss impairment rates were employed by UCSF and RTI.

Mortality Costs

UCSF and RTI used the same methodology in estimating mortality costs, which are 51 percent higher for 1985 than for 1980. The difference is mainly due to: a) inflation in weekly earnings, amounting to a 27 percent increase from 1980 to 1985; and b) different definitions of ADM deaths, especially alcohol-related deaths. In 1985, 25,600 more deaths due to alcohol abuse or alcohol-related diagnoses were identified.

Other Related Costs

UCSF and RTI used similar methodologies in estimating other related costs, but different sources were used for several cost categories. The total of other related costs is 63 percent higher in 1985 than in 1980. Inflation increases and changes in sources of data and in methodology contributed to the differences between the two years. For example, the estimation of lost productivity in 1985 due to crime careers was calculated using an approach that is based on epidemiologic data obtained from NIDA and demographic data from the 1985 National Household Survey on Drug Abuse. RTI based their estimates on the 1974 Treatment Outcome Prospective Survey.

RELIABILITY OF THE COST ESTIMATES

The cost estimates presented in this report are based on the most current and reliable data available and new methodology developed specifically for this study. We believe that this research has produced conservative estimates. Following are summary highlights of the reasons for concluding that our estimates are conservative for several cost categories. Underestimation may be partially offset by the few sources of overestimation.

Short-Stay Hospital Costs

Hospital discharge data records may not list ADM secondary conditions for all primary diagnoses known to be associated with ADM disorders, especially injuries and other primary diagnoses that are alcohol-related. Studies have shown that physicians are less likely to report as alcoholic patients with higher incomes, higher educational levels, or private medical insurance; women; and those who deny heavy alcohol intake (Moore et al., 1989).

Our listing of primary ADM diagnoses does not include several diagnostic categories (such as pellagra, chronic hepatitis, and cirrhosis of liver without mention of alcohol) that NIAAA considers alcohol-related, thereby underestimating short-stay hospital costs by about 11 percent.

The average expense per patient day in all non-federal community hospitals is applied to days of care. Since most ADM short-stay hospital episodes do not involve surgery, the average expense per day for ADM patients is probably less than for the average patient, which is likely to overestimate the costs.

Nursing Home Costs

Costs of nursing home care are based on the number of nursing home residents with ADM diagnoses, including principal and secondary diagnoses, multiplied by the annual charge per resident. To the extent that elderly people with ADM diagnoses may require nursing home care in the absence of ADM disorders, the nursing home costs may be considered to be on the high side.

Support Costs

It is reasonable to assume that part of the total cost of construction of medical facilities, amounting to \$8.1 billion in 1985, is spent for construction of facilities that serve the ADM population. Such an estimate, however, is not included in the current study because there are no data on which to base such an estimate. For this category, therefore, the costs are understated.

Morbidity Costs

No estimates were made for ADM-related income loss among the transient and the military populations, resulting in underestimation of costs.

Estimates of income loss among the civilian noninstitutionalized resident population are calculated only for the population aged 18 to 64. To the degree that those under age 18 and over 64 suffer earnings losses due to ADM disorders, the costs are understated.

Productivity losses are based on personal income rather than personal earnings. Personal income, which includes receipt of transfer payments, may be less sensitive to the effects of ADM disorders than personal earnings, resulting in possible understatement of costs.

Mortality Costs

A 6 percent discount rate is employed to estimate the present value of future earnings lost in order to be consistent with the RTI approach. Use of a lower, and

perhaps more appropriate, discount rate would yield higher mortality costs. Using the 6 percent discount rate results in understatement of mortality costs.

Full-time year-round earnings for the civilian noninstitutionalized population and average life expectancy are used in the estimates of forgone earnings. These measures should be adjusted to reflect earnings and life expectancy without ADM disorders, but data are not available to make these adjustments, thereby introducing a downward bias into the estimates.

Other Related Costs

UCSF and RTI used similar methodologies in estimating other related costs, but different sources were used for several cost categories. The total of other related costs is 63 percent higher in 1985 than in 1980. Inflation increases and changes in sources of data and in methodology contributed to the differences between the two years. For example, the estimation of lost productivity in 1985 due to crime careers was calculated using an approach that is based on epidemiologic data obtained from NIDA and demographic data from the 1985 National Household Survey on Drug Abuse. RTI based their estimates on the 1974 Treatment Outcome Prospective Survey.

CHAPTER II

CONCEPTUAL ISSUES RELATED TO COST-OF-ILLNESS STUDIES

Cost-of-illness studies have been conducted during the past three decades by economists, sociologists, public health specialists, policy analysts, and many others. They have produced a variety of cost estimates for illness in general and for specific diseases, including the costs of alcohol abuse, drug abuse, and mental illness (ADM).

Table 9 presents the costs of ADM from past studies as well as from the current study. These data show, as expected, that the costs have risen over the years. More importantly, however, is the considerable variation among the studies in the distribution of direct and indirect costs and in the level of costs in studies for the same years. These variations are due to the use of different methodologies, estimating procedures, sources of data, and discount rates. For example, the effects of direct and indirect costs of illness have been changing over time, with a dramatic increase in direct costs relative to indirect costs in recent years. In 1963, the indirect costs of mental illness were twice the direct costs (Rice, 1966). By 1980, direct costs had increased so rapidly that the relationship between the two types of costs was reversed with direct costs almost twice the indirect costs (Rice et al., 1985), reflecting the high rate of inflation in medical care costs and smaller rates of increase in wages over the 17-year period.

Another major source of differences in the aggregate level of costs is the inclusion of "other related costs" or nonhealth-related costs, discussed in more detail at the end of this chapter. In her previous cost-of-illness studies, Rice estimated only direct costs. In contrast, the Research Triangle Institute estimated the economic costs of ADM for 1977 and 1980, including other related costs associated with these disorders (Cruze et al., 1981; Harwood et al., 1984). These other related costs ranged from 1 percent of total costs of mental illness to 68 percent of drug abuse costs in 1977 and from 3 percent of mental illness costs to 37 percent of drug abuse costs in 1980.

Concern for the lack of consistency and comparability among studies led to the establishment in 1978 of a U.S. Public Health Service task force on cost-of-illness studies, chaired by Dorothy P. Rice, Director of the National Center for Health Statistics at that time. The task force was charged with recommending methodological guidelines to assure that the results of future studies could be better compared (Hodgson and Meiners, 1979). The recommendations were designed so that the objectives of individual cost-of-illness studies could be achieved while promoting conformity to enhance the comparability of the results of studies. The effect was to formalize and unify the manner in which cost-of-illness studies would be conducted thereafter.

Pursuant to the guidelines, therefore, costs measured in cost-of-illness studies are the value of resources used (direct costs) or lost (indirect costs) as a result of illness across a defined population. Public assistance payments, such as disability and welfare payments, are not counted since they represent monetary transfers, rather than net increases in the use of resources.

Table 9

ADM COST STUDIES
(\$ in millions)

Source	Study Period	Total	Direct Costs	Indirect Costs		Percent Distribution	
				Amount	Discount Rate	Direct	Indirect
ALCOHOL ABUSE COST STUDIES							
Berry et al., 1977	1971	\$29,428	\$14,559	\$14,869	6	49.5	51.5
Cruze et al., 1981	1977	49,374	10,813	38,561	6	21.9	78.1
Harwood et al., 1984	1980	89,526	17,953	71,573	6	20.1	79.9
Harwood et al., 1984	1983	116,674	23,861	92,810	6	20.5	79.5
Rice et al., 1990	1985	70,338	15,801	54,537	6	22.5	77.5
DRUG ABUSE COST STUDIES							
Little, 1974	1973	9,749	8,222	1,527	10	84.3	15.7
Rufener et al., 1977	1974-75	10,338	4,932	5,406	NA	47.7	52.3
Cruze et al., 1981	1977	16,387	6,066	10,321	6	37.0	63.0
Harwood et al., 1984	1983	59,747	9,294	50,453	6	15.6	84.4
Rice et al., 1990	1985	44,052	15,481	28,571	6	35.1	64.9
MENTAL ILLNESS COST STUDIES							
Fein, 1958	1954	3,649	1,723	1,926	4	47.2	52.8
Rice, 1966	1963	7,277	2,402	4,875	4	33.0	67.0
Conley and Cornwell, 1970	1968	20,000	4,000	16,000	NA	20.0	80.0
Levine and Levine, 1975	1971	25,237	11,058	14,179	5	43.8	56.2
Cooper and Rice, 1976	1972	13,917	6,985	6,932	4	50.2	49.8
Levine and Willner, 1976	1974	36,786	16,973	19,813	5	46.1	53.9
Paringer and Berk, 1977	1975	18,201	9,411	8,790	2.5	51.7	48.3
Cruze et al., 1981	1977	40,287	18,745	21,542	6	46.5	53.5
Harwood et al., 1984	1980	54,236	25,288	28,948	6	46.2	53.4
Rice et al., 1985	1980	30,685	19,824	10,861	4	64.6	35.4
Harwood et al., 1984	1983	72,775	35,501	37,274	6	48.8	51.2
Rice et al., 1990	1985	103,691	44,206	59,485	6	42.6	57.4

For any illness or group of illnesses, these costs fall into two major categories: core and other related costs. Core costs are those resulting directly from the illness in question, whereas other related costs are the costs of secondary, nonhealth effects of the illness. Within each category, there are direct and indirect costs. Direct costs are those for which payments are actually made, and indirect costs are those for which resources are lost.

Literature on cost-of-illness studies has proliferated, as documented in the annotated bibliography undertaken as part of the current research conducted by the University of California, San Francisco (Jarvinen, 1988). The annotated bibliography provides a systematic search of the cost-of-illness literature in general and the cost of ADM illnesses in particular since 1980. It focuses on empirical cost-of-illness studies and on the theoretical and methodological studies of conceptual issues and economic valuation of life.

The literature on conceptual issues, including prevalence vs. incidence approaches and human capital vs. willingness-to-pay approaches, is summarized below. Several estimation issues relevant to the economic costs of ADM in the present report are discussed. Included are the following: valuing psychosocial costs, reduced productivity, household services, and non-market use of resources (informal caregivers). Other methodological issues include the use of discount rates, accounting for consumption, estimation of earnings, inclusion of transfer payments, use of costs versus charges, and addition of nonhealth-related costs.

LITERATURE ON CONCEPTUAL ISSUES

Prevalence-Based Cost Estimates

Two approaches can be used in estimating the cost of illness by the human capital method. Prevalence-based costs provide an estimate of the direct and indirect economic burden incurred in a period of time (the base period) as a result of the prevalence of disease, a period most often a year. Included are the costs of the base year or any time prior to the base year. Prevalence-based costs measure the value of resources used or lost during a specified period of time, regardless of the time of disease onset. In estimating the economic burden resulting from the prevalence of disease, the present discounted value of future losses due to mortality are calculated. The conventional methodology attributes the future losses to the year in which the death occurred. Most cost-of-illness studies employ the prevalence-based approach, and it is the one employed in the current study of the economic costs of alcohol and drug abuse and mental illness.

Incidence-Based Cost Estimates

Incidence-based costs represent the lifetime costs resulting from the disease or illness. In the aggregate, incidence-based costs refer to the total lifetime costs of all cases with onset of disease in a given base year. Incidence-based costs are difficult to estimate because they require knowledge of the likely course of a disease and its duration, including survival rates since onset, medical care that will be used and its cost during the duration of the disease, and the impact of the disease on employment, housekeeping, and earnings (Hodgson, 1983; 1988; Scitovsky, 1982).

Relatively few incidence-based studies exist, but the current state of the art is illustrated by Hartunian, Smart, and Thompson (1980), who estimate the costs of cancer, coronary heart disease, stroke, and motor vehicle injuries; Policy Analysis, Inc. (1981), who examine the costs of breast cancer, diabetes mellitus, rheumatoid arthritis, stroke, and acute lymphocytic leukemia; Oster, Colditz, and Kelly (1984), who estimate the costs of smoking and benefits of quitting; and Rice and MacKenzie (1989), who estimate the lifetime cost of injury. These studies investigate direct and indirect costs by modeling the disease process from onset until cure or death, including the trends of important parameters such as incidence, survival, use and cost of medical care, and time lost from work and housekeeping. In each of these studies, a great deal of effort was expended in locating and making the most of available data, which often were originally gathered for other purposes and/or were incomplete and had to be modified to meet the needs of incidence cost analysis. These studies are impressive in their demonstration that incidence-based costs are methodologically feasible, and in their use of extensive sensitivity analysis to reveal the impact of alternative assumptions and parameter values on estimated costs.

An incidence approach to estimating the costs of AIDS is more feasible than for most other illnesses. The period from diagnosis of AIDS to death has been less than two years for most cases; following AIDS patients for this period to obtain their medical care costs is feasible. For example, Scitovsky and associates (1986) estimated that lifetime hospital costs in 1984 prices most likely ranged between \$60,000 and \$75,000, based on careful examination and tabulation of hospital records. For most other diseases, however, the period from onset of the disease to death is considerably longer, thus requiring longer periods of follow-up.

Human Capital vs. Willingness-to-Pay Approaches

Economists generally employ two approaches to valuing human life. One is the human capital approach, refined by Rice (1966) and her colleagues (1985); the second is the willingness-to-pay approach, first proposed by Schelling (1968) and Mishan (1971). In addition, there have been attempts to further refine these methods and to link them together (Landefeld and Seskin, 1982). The following sections briefly review the literature on these approaches and summarize the advantages and limitations of each.

Human Capital Approach

According to the human capital approach, an individual's value to society is his or her production potential. If markets are functioning well, individuals will be paid a wage equal to the value of the output they produce. Thus, the value of a person to society can be measured by his or her earnings and the value of life would then be the future earnings stream. This stream of earnings is discounted using a discount rate that reflects the trade-off between the values of a dollar today and a dollar tomorrow.

The human capital approach is the most commonly used approach for valuing human life (Rice et al., 1985). It assumes a social perspective and has the important advantage of relying on data that are readily available. It is relatively easy to apply and is useful for answering questions regarding the economic burden of a disease for a specific time period (e.g., strokes in 1985) or for cost-

benefit analysis (e.g., determining the cost savings of a specific procedure or intervention program that reduces illness and/or improves survival rates).

Studies employing the human capital approach estimate the direct and indirect costs of specific categories of illnesses. Direct costs are those for which payments are made and indirect costs are those for which resources are lost. Estimates of direct costs are usually straightforward. They include expenditures for medical care, including hospital and nursing home care, services of medical professionals, drugs, and appliances.

The measurement of indirect costs, however, involves the estimation of the value of human life, which raises conceptual and data issues. The estimation of indirect costs employs present discounted values of earnings according to age and sex. The measure of output loss is earnings, adjusted for wage supplements. This valuation rests on the assumption that earnings reflect productivity. It is common practice to impute a value for household work performed by both men and women and to add this value to earnings to obtain a composite mean present lifetime earnings by age and sex.

This method has some disadvantages. Because it values life using market earnings, it yields very low values for children and the retired elderly. The human capital approach also undervalues life if labor market imperfections exist and wages do not reflect true abilities. For example, women and minorities are often paid a lower wage than men in comparable jobs. Thus, men are more highly valued than women, white persons more than black persons, and middle-aged people more than the young and elderly. In addition, some individuals may have low productivity as a result of a particular illness. For example, intravenous drug abusers and alcoholics may experience lower productivity than those who are not suffering from such health problems. Ideally, one would like to adjust earnings for such factors as race and sex discrimination and ill health. In practice, this is extremely difficult to do.

The human capital approach has also often been criticized as, at best, an incomplete measure of the value of life and, at worst, an irrelevant calculation without appropriate conceptual foundation. More specifically, some economists argue that it has no basis in the field of welfare economics (Jones-Lee, 1976; Mishan, 1971; Schelling, 1968). Psychosocial costs, such as pain and suffering, are components of the burden of illness omitted from the human capital computation of indirect costs. These affect the quality of life and should presumably be reflected in certain measures of the value of life, such as by the willingness-to-pay approach discussed below.

The human capital methodology does measure an important component of the cost of disease, and it should be evaluated on the basis of how well it measures this aspect of the burden of disease and whether this is useful. Morbidity and mortality destroys labor, a valuable economic resource, by causing persons to lose time and effectiveness from work and other productive activities, forcing them out of the labor force completely, or bringing about premature death. Disease thus creates an undeniable loss to individuals and society, and it is this loss that the human capital approach attempts to measure (Hodgson and Meiners, 1982).

Willingness-to-Pay Approach

The willingness-to-pay approach is often described as an alternative methodology for valuing human life. In reality, it is a conceptually different approach that captures other aspects of the value of life and is therefore useful for different purposes (Rice and Hodgson, 1982). The willingness-to-pay method is based on the principles of welfare economics. It values human life according to what individuals would be willing to pay for a change that reduces the probability of illness or death (Schelling, 1968; Acton, 1975). This method could be helpful in indicating how individuals value health and life, in deriving social preferences regarding public policy, and in assessing the burden of pain and suffering, which have an intangible quality not amenable to evaluation in terms of the monetary value of resources used or forgone. This approach takes the individual perspective and incorporates all aspects of well-being, including labor and non-labor income, and the value of leisure, pain, and suffering. It has been suggested that this approach is particularly well-suited to capturing the intangible aspects of illness and could be used to complement the human capital approach.

Landefeld and Seskin (1982) attempt to calculate the value of life using an approach that links the human capital and the willingness-to-pay methods. They ask what an individual would be willing to pay to avoid earnings losses associated with risk to life and health. This approach takes into account the fact that willingness to pay may exceed expected earnings loss. Using this method, Landefeld and Seskin obtain estimates for the value of life that are approximately four times as large as those obtained using the human capital approach.

The literature on willingness to pay as a measure of the value of human life has grown in recent years. Some studies are theoretical (Broome, 1985; Fischhoff et al., 1987; Lipscomb, 1982; Mishan, 1988; Rosen, 1988; Smith, 1987); some are philosophical (Gillette and Hopkins, 1988; Menzel, 1986; Miller, 1988; Robinson, 1986; Viscousi, 1986; Wenz, 1986); others are empirical (Arthur, 1981; Blomquist, 1988; Dardis, 1980; Hammitt, 1988; Marin and Psacharopoulos, 1982; Thompson et al., 1982; Muller and Reutzel, 1984; Jones-Lee et al., 1985; Berger et al., 1987). Estimates of the value of human life using the willingness-to-pay approach range from less than \$10,000 to as much as \$5.6 million. This wide variation illustrates the many different approaches, methodologies, and databases used.

Miller (1989) evaluated 49 studies and concluded that 29 were of reasonably good quality. Across the 29 studies, the individual willingness to pay to save one life ranges from \$1.0 million to \$3.1 million, with a mean of \$1.95 million (Rice and MacKenzie, 1989, Table 24).

The human capital and willingness-to-pay methods are not simply alternatives. Together or separately, each can contribute to greater understanding of the burden of disease and other hazards. Unfortunately, the precise nature of the relationship between values calculated by the human capital approach and those implied by the willingness-to-pay method has not been determined. It is not known to what extent the two values would differ if willingness to pay for small reductions in mortality risk could be calculated. Lifetime earnings estimated by the human capital method may be used as the lower range of the amount a person is willing to pay for a decreased risk of death (Linnerooth, 1979; Blomquist, 1981; Institute of Medicine, 1981).

A review by Robinson (1986) makes a strong case that the willingness-to-pay method is a fundamentally "incorrect" method of valuing life for cost-effective public policy. Robinson concludes that it is subjective and suffers from circularity because the values placed by individuals on governmental health programs are clearly influenced by those programs.

Objections to the willingness-to-pay method are: that it is exceedingly difficult to implement in practice, and that the value of individual lives depends on income distribution, with the rich able to pay more than the poor. People have great difficulty in placing a value on small reductions in the probability of death. The strengths and weaknesses of these two methodologies are discussed fully in two articles on the state of the art of cost-of-illness estimation by Hodgson and Meiners (1982) and by Hodgson (1983).

The human capital approach is still most often used in cost-benefit and cost-effectiveness analyses that seek to evaluate alternative demands for scarce health care resources and promote economic rationality in health services policy, planning, and management. Most cost-of-illness studies use the human capital approach because it provides valuable information based on reliable statistics, so long as one realizes its limitations. This approach is used in the current study of the costs of alcohol and drug abuse and mental illness. In addition to estimating the present value of future earnings lost as part of the indirect costs, estimates of the years of life lost also will be presented. This measure is especially important in comparing the economic impact of ADM because many ADM victims die at young ages.

LITERATURE ON ESTIMATION ISSUES

In principle, cost-of-illness studies employ standard estimating procedures for the estimation of direct and indirect costs. The specific estimating procedures, however, vary according to the particular disease and the available sources of data. A number of issues relating to cost estimation are discussed below. These include valuing psychosocial costs, reduced productivity, household services, earnings, non-market use of resources, discount rates, transfer payments, costs versus charges, and nonhealth-sector costs.

Psychosocial Costs

Illness and disease are responsible for a wide variety of deteriorations in the quality of life frequently referred to as psychosocial costs. Victims of illness and disease, families of ill persons, and those who render care may all be affected. Sick people may suffer disfigurement, disability, and the pain and grief of impending death. They and those around them may be forced into economic dependence and social isolation, relocation of living quarters, and other undesired changes in life plans (Hodgson and Meiners, 1982). The combination of financial strain and psychosocial problems can be especially devastating.

Some psychosocial costs can be measured, such as the influence of mortality on the family and its life cycle (World Health Organization, 1976; Feichtinger and Hansluwka, 1977). For example, consequences of disease resulting in dissolution of marriage, widowhood, and orphanhood can be measured (Preston, 1974). Changes in residence, and loss of jobs can also be

measured. To a large extent, however, measures and methodology for estimating psychosocial costs remain to be developed. Measures are required for the impact of sickness on a person in terms of a sense of well-being, including evaluations of well-being of family and associates in addition to the individual with the illness. Indicators must reflect the reduced self-esteem, emotional problems, pain and suffering, disability, social isolation, economic dependence, impending death, and otherwise reduced quality of life that often accompany a disease (Hodgson and Meiners, 1982).

The difficulties associated with quantifying psychosocial costs cause them to be omitted from cost-of-illness estimates. Constructing valid quality-of-life indicators and relating them to measures of health status is a major problem. In addition, integrating non-monetary information on quality of life with the dollar magnitudes estimated for direct and indirect economic costs is extremely difficult. No attempt is made to quantify psychosocial costs in the present study.

Reduced Productivity

Reduced productivity is the value of losses to society due to impaired labor power of persons who may or may not be recognized by employers as alcohol or drug abusers or persons suffering from mental illness. Cost-of-illness studies, except for studies of the cost of ADM illnesses, generally have not quantified these losses. Past research on the economic costs of alcohol and drug abuse have yielded estimates of the value of losses due to reduced productivity (Berry et al., 1977; Cruze et al., 1981; and Harwood et al., 1984). The method used is to take the difference in earnings or income between abusing and nonabusing groups as a measure of the effect of alcohol abuse, drug abuse, and mental illness on earnings. Attempts are made to account for other factors, such as age, education, and family structure, that undoubtedly influence earnings. This general approach is employed in the present study.

Valuing Household Services

Marketplace earnings underestimate the loss resulting from women's illnesses because many women are not in the labor force. Because many women and some men keep house and are not in the labor force, the value of household work must be added to earnings. Walker and Gauger (1980) produced the most frequently used estimates of the value of primary and secondary household production. They used data on time-motion studies of housekeepers multiplied by the relevant market wages for various services performed to obtain an estimate of the cost of replacing the housekeeper's duties with person-hours from the labor force. Valuation was done on a task-by-task basis. The value of housekeeping services for women not in the labor force as well as for employed men and women is estimated.

More recently, Peskin (1984) used a somewhat different estimation technique. Like Walker and Gauger, her methodology involved calculating the mean time inputs for men and women who keep house and valuing the contributions by specific tasks performed with the prevailing wage rate for performance of similar tasks. The data were then analyzed in a regression framework so that controls for socioeconomic and demographic factors could be made.

Other studies of the value of household production have been conducted, but each has its limitations. Using the Walker and Gauger data as a basis, Brody (1975) produced estimates of the value of household production by full-time female homemakers. Brody ignored the household production of men and women engaged in market work. Murphy (1982) calculated per person annual values of household work based on the hours of work figures given by survey respondents, and calculated national averages for men and women by controlling for differences between the sample and population distributions of age, sex, education and urbanicity. However, Murphy did not control for labor force participation, marriage, and household size differentials. An unpublished review of these and other studies by Kenney (1987) concludes that the Peskin estimates are the best available. The current study refines these Peskin estimates and updates the values to 1985 wage rates based on tasks performed.

Earnings

In cost-of-illness studies, the appropriate measure of output loss for individuals is generally recognized to be earnings, and the usual measure of expected earnings is the arithmetic average or mean. Estimates of output losses are generally based on annual mean earnings by age and sex, adjusted for wage supplements such as employer contributions for social insurance, private pensions, and welfare funds. Rice and associates (1985) employ cross-sectional profiles of mean earnings by age and sex to estimate lifetime earnings. In applying these data, it is assumed that the future pattern of earnings for an average individual within a sex group will follow the pattern reported by the Bureau of the Census during a base year. This model recognizes that the average individual may expect earnings to rise with age and experience in accordance with the cross-sectional data for that year. Future changes in productivity of wage earners also need to be taken into account. Based on average changes in hourly earnings between 1980 and 1986, a 1 percent annual increase in productivity is assumed (U.S. Bureau of the Census, 1987c).

The economic assumption behind the use of earnings as a measure of the value of forgone output is that individuals are paid the value of their marginal product. To the extent that certain subgroups of the population are discriminated against in employment, actual earnings may be less than the value of output. Thus, mortality costs for diseases that primarily affect women and blacks may be underestimated. The indirect costs for diseases that affect a population with above-average productivity will also be underestimated if mean earnings are used to measure forgone output.

In estimating the direct and indirect costs of AIDS, Scitovsky and Rice (1987) assumed that persons with AIDS have the same average productivity as all others in their age and sex group as measured by mean earnings. There were no hard data on the earnings of persons with AIDS although there was some anecdotal evidence that male homosexuals have above-average earnings. On the other hand, the majority of persons with AIDS who are intravenous (IV) drug users have little or no income, or income from illegal sources (drug dealing, theft, and prostitution). It would be difficult, if not impossible, to estimate earnings for this group.

The use of mean earnings for people who suffer from diseases that afflict certain socioeconomic groups may be incorrect. Perhaps it would serve a useful purpose to calculate human capital values by occupation and level of education.

On the one hand, human capital values would be more accurate for certain groups defined according to these parameters. This could be important, for example, for estimating the cost of illness related to occupational exposure. On the other hand, for diseases not related to occupation or level of education, values for more broadly defined groups, such as men and women at a given age, may be all that is required. Further, while age, race, and sex can generally be determined for a specified disease group, such as deaths due to cancer, information on education and occupation are not readily available (Hodgson and Meiners, 1982). The current study employs mean earnings adjusted for wage supplements.

Non-Market Use of Resources

Although the health care delivery system is able to meet some of the needs of ADM patients and patients with other chronic diseases, a large share of the burden in caring for such patients falls on relatives, friends, and community networks of volunteers who receive no monetary remuneration for their essential services. In measuring the amount of resources that society devotes to health and long term care, we generally confine ourselves to the dollar value of services purchased in the marketplace, such as nursing home care and home health services. The size of the informal care network can, however, exert an important impact on the level of health expenditures. If individuals become unable or unwilling to devote the time and resources to caring for family and friends, many of the services now provided informally might have to be purchased in the market. If the availability of informal caregivers were reduced because of factors such as increased participation in the labor force by women and reduced family size, an increase in nursing home or home health expenditures might well follow (Paringer, 1985).

Few studies, however, have examined the issues and estimated the costs related to the provision to individuals with specific diseases of informal care services such as household chores, personal care tasks, and accompanying the impaired person on errands and to physician visits.

Arno (1986) estimated the value of volunteer services provided by three major AIDS community volunteer groups in San Francisco. A low and high value were estimated, based on minimum wage rates and market wages for services provided. A study by Paringer (1983) found that three-fourths of the functionally dependent, noninstitutionalized elderly relied primarily on family and friends for care. These findings also suggested that time demands placed on informal caregivers were directly related to the ability of the impaired person to perform basic activities of daily living, ranging from 9 to 27 hours of informal care per week. Based on forgone market earnings, it was estimated that the cost of informal care in 1979 amounted to \$7.2 to \$18.0 billion dollars (Paringer, 1983).

A recent study conducted for NIMH estimated the economic expenses of families of the chronically mentally ill (Franks, 1987). The conclusion was that families are likely spending over \$2 billion per year on behalf of their ill family members because of their mental illness. Included are expenses for medical treatment as well as for transportation, clothing, pocket money, food, legal fees, recreation, rent, and other miscellaneous expenses. Franks also estimated the value of time of family caregivers provided to the mentally ill at \$2.5 billion. Values were imputed for lost work, time with lawyers, recreation, talk with professionals and with clergy, caregiving, and other miscellaneous activities.

This latter figure is incorporated in the current study as an "other related" indirect cost of mental illness.

Discount Rates

The calculation of the present value of expected lifetime earnings raises questions about the importance of discounting and choosing the appropriate discount rate. From the economist's viewpoint, the arithmetic sum of lifetime earnings overstates the present value of an individual. Determining the present value of the future earnings stream is the correct way to measure economic value over a period of time; discounting converts a stream of earnings into its present value.

Economists agree that comparison of streams of earnings over varying time spans should employ the process of discounting and that the benefits of public projects for which cost-of-illness estimates are used should be discounted at the social rate of time preference. This rate correctly states society's preference for present versus future consumption. Unfortunately, the social rate of time preference is unobservable and the actual value is uncertain. Hodgson and Meiners (1982) discuss the discount rate in more detail and recommend that investigators employ at least two, and preferably three, discount rates ranging from 2.5 percent to 10 percent.

The higher the discount rate, the lower the present value of a given stream of earnings. With a high discount rate, earnings far into the future yield a relatively small present value. Conversely, lowering the discount rate increases the present value of future earnings. It is important for policymakers to know whether cost estimates are appreciably affected by alternative discount rates. Costs of illness estimated in two different studies and for the same base period, whether for the same illness or not, can only be meaningfully compared if identical discount rates are employed.

In the present study, three discount rates are used – 4, 6, and 10 percent. The summary tables and discussion of mortality costs are based on a 6 percent discount rate to permit comparisons with the previous Research Triangle Institute (RTI) studies.

Consumption

In the past, whether the cost of morbidity and mortality due to illness is an individual's output or an individual's output minus his or her consumption has been questioned (Weisbrod, 1961). The concern of most studies is with the cost of illness to society. The individual, not just the output he or she contributes in excess of consumption, is valued by society. Economists today generally agree that consumption should not be deducted (Mishan, 1971). In accordance with current accepted methodology, consumption is not deducted from the individual's output in the present study.

Costs vs. Charges

In measuring direct costs, charge data are more frequently used than cost data, despite the fact that charges do not necessarily reflect resource use. For example, hospitals often charge less than costs for some services (e.g., maternity beds) and substantially more than costs for others (e.g., laboratory tests). Charge

data are generally more accessible than cost data; most services have fee schedules (with the exception of the services of volunteers and families/friends). Some institutions, such as hospitals, have cost-to-charge ratios that can be used to derive an approximation of costs from charge data, but such a ratio is unavailable for many other services, such as physicians or home health care.

If charge data for some services are converted to costs and others are not, total cost calculations will be inaccurate because of the mixture of data in different units. Factors such as reimbursement methods can have an impact on the determination of costs, as illustrated by the implementation of DRGs under Medicare. Most researchers use charge data in cost studies because of accessibility and the lack of proven alternatives. The present study uses charges or expenditure data for most of the direct cost components.

Transfer Payments

Using the human capital method, costs of illness and disease are the value of resources used and resources lost due to morbidity and mortality, both resulting in forgone alternatives. Transfers, on the other hand, are shifts, as the name implies, of control over the use of resources. Direct and indirect costs are unambiguous losses that would not occur if illness and disease were reduced, while transfers take resources from one segment of society and give them to another. Transfers may alter the allocation of resources, but are not a use of resources in and of themselves (Hodgson and Meiners, 1982).

Taxes and transfer payments, such as public aid and disability payments, are not costs of illness and disease and should not be added to direct and indirect economic costs. Taxes will already have been counted in indirect costs, and transfer payments are simply a reallocation of income from one individual (e.g., the wage earner) to another (e.g., the disabled person). Although these transfers represent a cost to the wage earner in the form of a reduction in disposable income, one person's loss is another's gain, and the net cost to society resulting from this transaction in terms of resources used (and thus unavailable for other alternatives) is zero, except for costs incurred in operating the system that effects the transfers. The inclusion and addition of transfer payments to direct and indirect costs of illness would result in double counting and are, therefore, not included in the direct cost estimates.

Nonhealth-Related Costs

The Guidelines for Cost of Illness Studies in the Public Health Service (Hodgson and Meiners, 1979) state that in addition to estimating the core direct and indirect costs, other related nonhealth-sector costs may be estimated. In recent years, several cost-of-illness studies have included estimates of nonhealth-sector costs. Mushkin and Landefeld (1978) estimated nonhealth direct costs between \$23 billion and \$29 billion in 1975, adding 19 to 23 percent to direct health care expenditures for all illnesses. These additional expenditures were by consumers for transportation to providers, property losses to fire and automobile accidents; by government for special education, vocational rehabilitation, counseling, added fire protection, and extra costs to the criminal justice system; and by industry for environmental and safety investments.

The Research Triangle Institute (RTI) estimated the economic costs to society of alcohol and drug abuse and mental illness for 1977 and 1980 (Cruze et

al., 1981; Harwood et al., 1984) and carefully documented the other related costs associated with these disorders. The other related direct costs varied for each illness. For alcohol abuse, these costs included motor vehicle crash losses, criminal justice system, fire losses, fire protection and highway safety. For drug abuse, the criminal justice and social welfare systems and drug traffic control were included. For mental illness, only the social welfare system costs were included.

Three types of other related indirect costs were estimated by RTI: 1) the opportunity costs of time for individuals who commit crime as a result of drug abuse; 2) the opportunity costs of time for individuals who are incarcerated as a result of conviction for alcohol or drug abuse related crime; and 3) the value of time lost by persons other than crash victims as a result of motor vehicle accidents caused by alcohol abuse or as a result of traffic delays resulting from such accidents. There were significant differences in the magnitude of these other related costs in relation to total costs, ranging from 1 percent for mental illness to 68 percent for drug abuse in 1977 and from 3 percent for mental illness to 37 percent for drug abuse in 1980.

It is clear that nonhealth-sector costs are variable and large in magnitude and an important component of costs originating in illness and disease. The present study includes estimates of other related direct and indirect costs, with some modifications to the methods employed by RTI.

CHAPTER III

TREATMENT AND SUPPORT COSTS

SHORT-STAY HOSPITAL COSTS

Short-stay hospital costs comprise a large share of the total medical care costs of persons suffering from alcohol abuse, drug abuse, and mental illness (ADM). Estimates of these costs are based on hospital discharge data. Among the measurement problems identified in the current study of ADM short-stay hospital costs are those related to "comorbidity," in which ADM disorders may play a secondary role to other diagnoses, and "overlap," in which alcoholism, drug abuse, and mental disorders may occur together. An adaptation of this chapter has been published (Rice and Kelman, 1989).

Examination of comorbidity and overlap was facilitated by using a systematic framework developed by the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA) Office of Financing and Coverage Policy in 1986 (Kaple and Cowell, 1988). The framework enables identification of comorbidity and conjoint ADM (overlap) and distinguishes among the three categories of ADM comorbidities and combinations.

Comorbidity and overlap issues are described and the relevant literature reviewed below. The methodology and source of data for measuring ADM comorbidity and overlap in short-stay hospitals is discussed and the findings presented. Finally, the implications of these findings for the costs of ADM disorders are examined.

Comorbidity Issues

Previous cost-of-illness studies do not systematically take into account the problem of comorbidity in which ADM disorders play a secondary role to other non-ADM primary diagnoses. To omit these comorbidity costs understates the total social burden of ADM. Previous ADM cost studies recognized the problem, but a reliable methodology was not developed to estimate the added costs, especially treatment costs, resulting from the coexistence of ADM disorders with other conditions or diagnoses.

The method used by the Research Triangle Institute (RTI) in its previous cost studies "involved identifying specific diseases and illnesses that are related to alcohol, drug abuse and mental illness and allocating costs based on the proportions of the illnesses or disease that are ADM related" (Harwood et al., 1984, p. 39). For example, the proportions representing alcohol abuse range from 28.8 to 80 percent of malignant neoplasms of esophagus, from 1.2 to 75 percent of malignant neoplasms of pancreas, from 2.8 to 42 percent of tuberculosis, and 11.6 to 68 percent of diseases of the pancreas. The means of these ranges are applied to hospital discharge data by cause of hospitalization. This method has been criticized by Heien and Pittman (1989) for the following reasons: 1) it violates the National Institute on Alcohol Abuse and Alcoholism (NIAAA) philosophy for using the most conservative estimate; 2) the average of the range is a poor estimator of the mean; and 3) the proportions were based on the mean of the ranges reported in an NIAAA (1978) report to Congress, which does not contain

any documentation of research to establish the causal role of alcohol in these various disorders.

Comorbidity of ADM disorders in relation to other diagnoses for hospitalized persons is a major problem that requires quantification in estimating ADM hospital costs. A recent study of medical and surgical patients discharged from two hospitals in New York City and Chicago shows that mean length of stay of the patients with psychiatric comorbidity is significantly longer than that of other patients (Fulop et al., 1987). The Fulop study confirms the importance of taking into account the magnitude of comorbidity of ADM illnesses for hospitalized patients with non-ADM diagnoses in estimating ADM treatment costs.

Findings from two new epidemiologic sources of data show strong associations between physical and mental health that illustrate a concept related to comorbidity. Wells and associates (1988a), using data from the Epidemiologic Catchment Area (ECA) Program in Los Angeles, show that persons with a recent psychiatric disorder have poorer perceived general health and more acute and chronic limitations in physical functioning than persons without such conditions. In another report employing the ECA database in Los Angeles, Wells and associates (1988b) document a higher prevalence of recent and lifetime psychiatric disorders among a general population with one or more of eight chronic medical conditions, relative to those without any of the conditions.

Using the established of Populations for Epidemiologic Studies of the Elderly (PEPSE), Berkman and associates (1988) find strong associations between depressive symptoms and functional disability and chronic conditions in an elderly cohort in New Haven, Connecticut. For alcohol abuse-related illnesses, another study shows the percent association of chronic conditions with alcohol use (General Electric Company and NIAAA, 1980). For many diseases, the ranges are very large (i.e., cancer of the buccal cavity and pharynx -- 2 to 43 percent; peptic ulcer -- .6 to 24.4 percent; cirrhosis of the liver -- 29.5 to 100 percent).

Special attention is given in several studies to the issue of alcoholism as a comorbid condition in hospitalized patients. The NIAAA has recently published a comprehensive report on hospital discharges with alcohol-related conditions (NIAAA, 1989). The NIAAA study reports that for 1985 almost 600,000 discharges are first-listed or principal alcohol-related diagnoses and more than 500,000 discharges are listed as additional or secondary diagnoses. These results are compared with our findings later in this chapter.

A comprehensive survey of all new admissions to adult inpatient services at Johns Hopkins Hospital screened for alcoholism. The prevalence of screen-positive alcoholism found in the hospitalized patients is high, ranging from 12.5 percent in obstetrics-gynecology to higher than 25 percent in psychiatry, orthopedics, and ear, nose and throat surgery (Moore et al., 1989). Several studies examine the prevalence of alcoholism in emergency room settings. A review of the literature by Teplin and associates (1989) shows the prevalence of alcoholism among emergency room admittees, ranging from 9 to 38 percent. Teplin and her colleagues report that approximately one-quarter of their 640 subjects had some level of blood alcohol and 16.3 percent had readings above .10 percent, the legal limit for operating a motor vehicle in most states. These studies clearly show that the prevalence of alcoholism in hospitalized patients

and in emergency room admissions is high, emphasizing the importance of including the costs of comorbidity of alcoholism in the estimates of ADM hospital costs.

Overlap Issues

Previous studies of the cost of ADM illnesses also assume that alcohol and drug abuse and mental illness are independent disorders, as if they never occur together in individuals. In reality, however, there is a considerable degree of overlap in the prevalence of the three disorders, and their effects are frequently interactive. This is significant for studies of the costs of ADM since the patterns affect the apportionment of costs among the three disorders.

Overlap between alcohol and drug abusers is an obvious example. In surveys of youth, a substantial overlap has been established between heavier drinkers and marijuana users (Rachal et al., 1982). Up to half of the heavier drinkers use marijuana at least once a week, and a third of the youth who use marijuana more than once a month are also classed as heavier drinkers. Data from the 1982 National Household Survey on Drug Abuse indicate that up to 50 percent of young adults who are heavier users of marijuana are also heavier drinkers (Miller et al., 1983). There is also likely to be significant overlap between mental disorders and alcohol and drug abuse. The Treatment Outcome Prospective Survey shows a high prevalence of symptoms of depression among drug abuse treatment populations (Rachal et al., 1981). Collins and Schlenger (1983) indicate that there is significant overlap between the addictive disorders and other mental disorders in prison populations. In their review of 75 studies, Grande and associates (1984) report a high degree of association among alcoholism, drug dependence, and antisocial personality. More recently, Wolf and associates (1988) show that alcoholism, antisocial personality, and drug dependence form a relatively homogeneous triad that is independent of other affective disorders.

Methodology and Source of Data

For the present study, we measure comorbidity and overlap of ADM disorders in short-stay hospitals by estimating directly from the National Hospital Discharge Survey (NHDS) the magnitude of utilization by individuals with ADM comorbidities and with more than one ADM disorder (overlap). For comorbidity, the NHDS public use data tapes provide the additional days of care (by age and sex) reported for all non-ADM primary diagnoses that have a secondary ADM diagnosis. Expenses per patient day are applied to these additional days of care to obtain the added short-stay hospital costs associated with ADM comorbid conditions.

A similar procedure is used for estimating the magnitude of overlap of ADM days of care in short-stay hospitals from the NHDS data tapes. In this case, the short-stay hospital costs are redistributed to each of the ADM disorders according to the primary and secondary ADM diagnoses reported. When multiple ADM diagnoses are listed (i.e., alcohol and drug abuse, alcohol abuse and mental illness, drug abuse and mental illness, or alcohol and drug abuse and mental illness), the discharges, days, and costs are divided evenly among the relevant categories. This approach results in a slight redistribution of costs from alcohol abuse and mental illness to drug abuse. Employing this methodology and data source produces direct estimates of the costs of comorbidity and the

Table 10

**ADM COMORBIDITY OF SHORT-STAY HOSPITAL DISCHARGES
BY DIAGNOSIS, 1984-86, (Three-Year Annual Average)**

<u>Diagnostic Category</u>	<u>Total[1]</u>			<u>No Secondary ADM Diagnoses[1]</u>			<u>With Secondary ADM Diagnoses[1]</u>		
	<u>Discharges (000's)</u>	<u>Days (000's)</u>	<u>Average Length of Stay</u>	<u>Discharges (000's)</u>	<u>Days (000's)</u>	<u>Average Length of Stay</u>	<u>Discharges (000's)</u>	<u>Days of Care (000's)</u>	<u>Average Length of Stay</u>
Total	39,292	243,882	6.21	36,232	214,695	5.93	3,060	29,187	9.54
Infectious & Parasitic Diseases	676	4,642	6.87	623	4,105	6.59	50	538	10.76
Neoplasms	2,431	20,686	8.51	2,341	19,573	8.36	91	1,116	12.26
Endocrine, Nutritional, Metabolic Disorders	1,451	10,234	7.05	1,267	8,640	6.82	185	1,594	8.62
Mental Disorders	1,721	20,991	12.20	931	11,179	12.01	789	9,809	12.43
Diseases of Nervous System & Sense Organs	1,316	6,897	5.24	1,216	5,959	4.90	102	936	9.18
Diseases of Circulatory System	5,542	43,599	7.87	5,014	39,024	7.78	526	4,573	8.69
Diseases of Respiratory System	3,270	19,682	6.02	2,987	17,259	5.78	282	2,425	8.60
Diseases of Digestive System	3,971	24,585	6.19	3,640	22,002	6.04	330	2,583	7.83
Diseases of Genitourinary System	2,860	15,061	5.27	2,744	14,103	5.14	118	958	8.12
Complications of Pregnancy, Childbirth, etc.	4,765	15,070	3.16	4,711	14,810	3.14	53	260	4.91
Diseases of Skin & Subcutaneous Tissue	2,752	19,280	7.01	2,595	17,735	6.83	154	1,546	10.04
Injury & Poisoning	3,333	22,142	6.64	2,987	19,548	6.54	348	2,593	7.45
Supplementary Factors	4,262	15,711	3.69	4,241	15,537	3.66	19	172	9.05
Other[2]	940	5,306	5.64	929	5,221	5.62	11	85	7.73

[1] Includes discharges with a primary ADM diagnosis.

[2] Includes congenital anomalies, certain conditions originating in the perinatal period, and symptoms, signs, and ill-defined conditions.

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

NOTE: Numbers may not add to totals due to rounding.

significance of overlap for ADM disorders in short-stay community hospitals. Such estimates were not made in the earlier ADM cost studies.

The analysis in the present study is based on the diagnostic data reported in the National Hospital Discharge Survey (NHDS). This survey is conducted annually by the National Center for Health Statistics (NCHS). It is a national sample of more than 400 short-stay hospitals, producing approximately 200,000 discharges annually. Included are demographic information on patients discharged, ICD coded discharge diagnoses and surgical procedures, length of stay, and expected source of payment. Data are abstracted from the face sheet of the patient's medical record. Up to five diagnoses and three operations are coded according to the International Classification of Disease (ICD-9-CM). To provide reliable estimates, the data presented herein are computed from the 1984, 1985, and 1986 public use tapes and averaged to produce annual estimates for 1985.

Findings

Comorbidity of ADM by Diagnosis

Table 10 shows the number of discharges and days of care in short-stay hospitals for all patients (including deliveries) and for those with and without secondary ADM diagnoses. The ADM diagnoses are listed in Appendix A. Of all the 39.3 million patients discharged, the vast majority, 92 percent, have no secondary ADM diagnoses listed; 88 percent of the total days of care are associated with these discharges. Included in this table are patients who have primary ADM diagnoses listed with or without a secondary ADM diagnosis reported on the medical abstract form. Thus, 8 percent of the total discharges and 12 percent of the days of care have a secondary or comorbid ADM diagnosis listed. The average length of stay for those with secondary ADM diagnoses is significantly higher than for patients without – 9.5 days compared with 5.9 days.

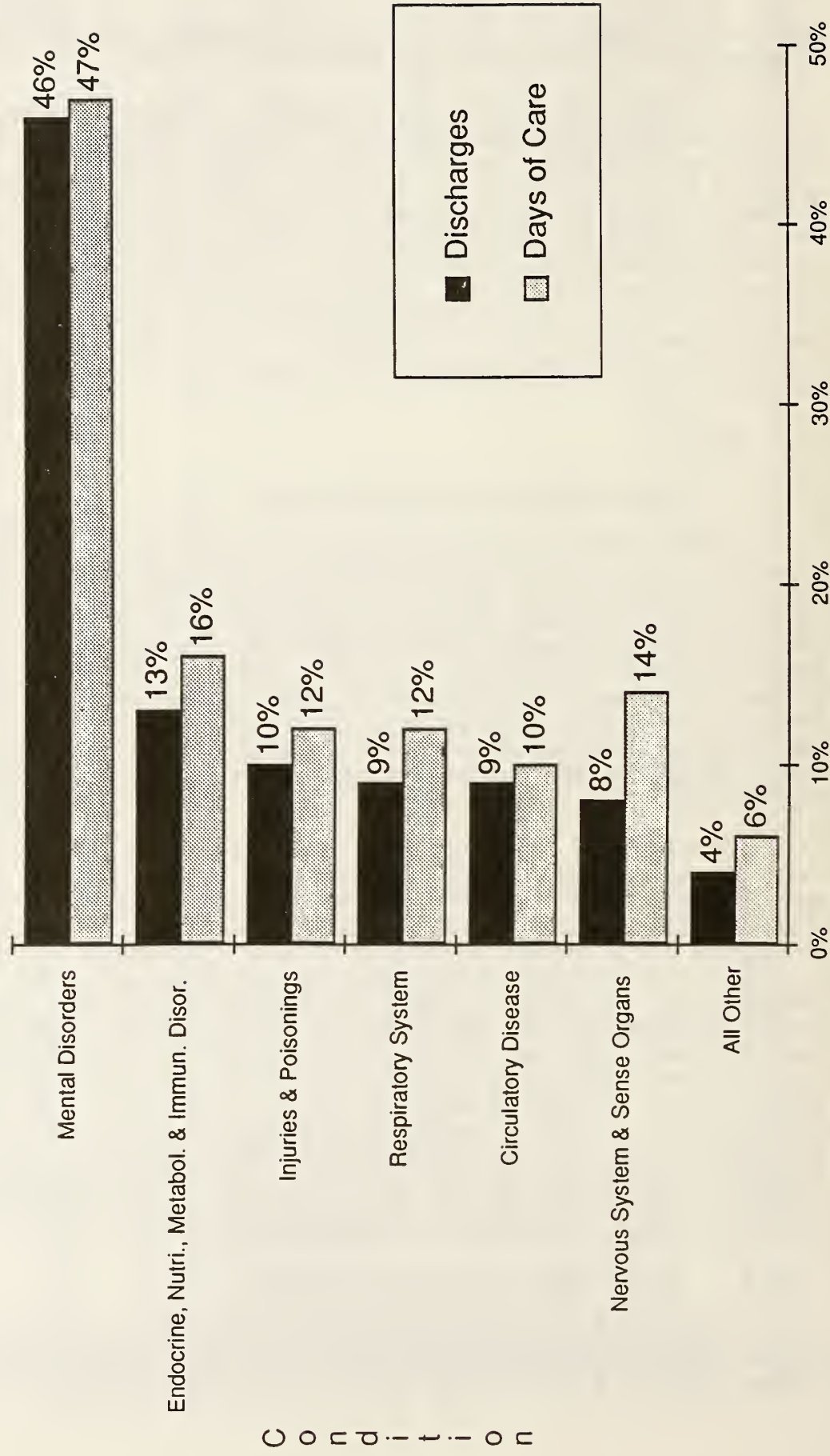
Examination of the data on Table 10 by diagnostic category shows that for every diagnosis, excluding mental disorders, average length of stay for those with secondary ADM diagnoses is longer, ranging from less than one day for diseases of the circulatory system and for injuries and poisoning to more than five days for supplementary classification of factors influencing health status (V-codes). For mental disorders, the length of stay for those with secondary ADM diagnosis is less than half a day longer than for those without. Not surprisingly, mental disorders have the highest rate of secondary ADM discharges – 46 percent of discharges and 47 percent of the days of care in this diagnostic category have a secondary ADM diagnosis (Figure 8). This category also has the largest absolute number of ADM comorbidity discharges. The endocrine, nutritional, and metabolic disorder category ranks second, with 13 percent of the discharges and 16 percent of the days of care reporting secondary ADM diagnoses. The injuries and poisonings category ranks third in the proportion of discharges with secondary ADM diagnoses followed by the respiratory, the circulatory, and the nervous system and sense organs categories.

Comorbidity of ADM by Sex and Age

To examine the magnitude of comorbid ADM conditions in short-stay hospitals, discharges with primary ADM diagnoses were excluded. A total of 1.9 million discharges and 22.1 million days of care are in this category; these ADM

Figure 8

Percent of Discharges and Days of Care with Secondary ADM Diagnoses by Diagnosis, 1984-1986



Source: National Hospital Discharge Survey

hospitalizations are discussed below in the analysis of comorbidity and the extent of overlap in ADM diagnoses in this group of hospitalizations.

Omitting all discharges with a primary ADM diagnosis leaves a total of 37.4 million discharges with 222 million days of care (Table 11). Since primary ADM hospitalizations are longer than those for other conditions, omitting them results in a lower overall average length of stay. Nevertheless, the average length of stay for hospitalizations with secondary ADM diagnoses is 2.8 days longer than for patients without -- 8.6 days compared with 5.8 days.

More women than men are hospitalized (deliveries are included), but men are somewhat more likely to have a secondary ADM diagnosis reported -- 6.3 percent of the male discharges compared with 5.6 percent of the female discharges (Figure 9). Significant variations, however, are found by age. The proportion of total discharges with secondary ADM diagnoses increases with age, rising from 1.0 percent for those under age 15, 4.2 percent for the 15-44 age group, 7.5 percent for the 45-64 age group, to 10.0 percent for those aged 65 and over (Figure 10). For days of care associated with secondary ADM diagnoses, the proportion of total days rises from 1.8 percent for the youngest age group to 11.5 percent for the elderly, indicating that ADM comorbidity among elderly patients is quite high.

Tables 12 and 13 distribute the secondary ADM diagnoses for the discharges with other than ADM primary diagnoses into the various combinations of alcohol, drug, and mental disorders by sex and age. Of the 2.2 million discharges with a secondary ADM diagnosis, 62 percent are with mental illness, 21 percent with drug abuse, and 11 percent with alcohol abuse. The remaining 6 percent are combinations of the three disorders reported as secondary ADM diagnoses. Of the 18.9 million days of care associated with a secondary ADM diagnosis, 67 percent are with mental illness, 17 percent with drug abuse, 11 percent with alcohol abuse, and the remaining 5 percent with a combination of the three disorders. The average length of stay for all hospitalizations with secondary ADM diagnoses is 8.6 days, with mental illness secondary stays being the longest at 9.2 days.

Mental illness as a secondary ADM diagnosis is significantly higher for women than men -- 69 percent for women compared with 53 percent for men. When alcohol abuse is reported as a secondary diagnosis, however, the rate is significantly higher for men than women. Almost one-fifth of the male discharges with a secondary ADM diagnosis report alcohol abuse as the secondary diagnosis, compared with one-twentieth of the women.

Of the 2.2 million discharges with a secondary ADM diagnosis, 48 percent are aged 65 and over (Table 13). By contrast, 27 percent of the 35.2 million discharges without a secondary ADM diagnosis are elderly. About three-fourths of the elderly discharges with secondary ADM diagnoses are mental illness secondary diagnoses compared with half of the under age 65 discharges.

Comorbidity of ADM Discharges by Sex and Age

For 1985, 1.9 million discharges from short-stay hospitals have a primary diagnosis of alcohol abuse or drug abuse or mental illness (Table 14). The average length of stay is 11.8 days. More than half (53 percent) of these discharges are men and their length of stay is about one day shorter than for

Figure 9

Percent of Discharges and Days of Care with
Secondary ADM Diagnoses by Sex, 1984-1986

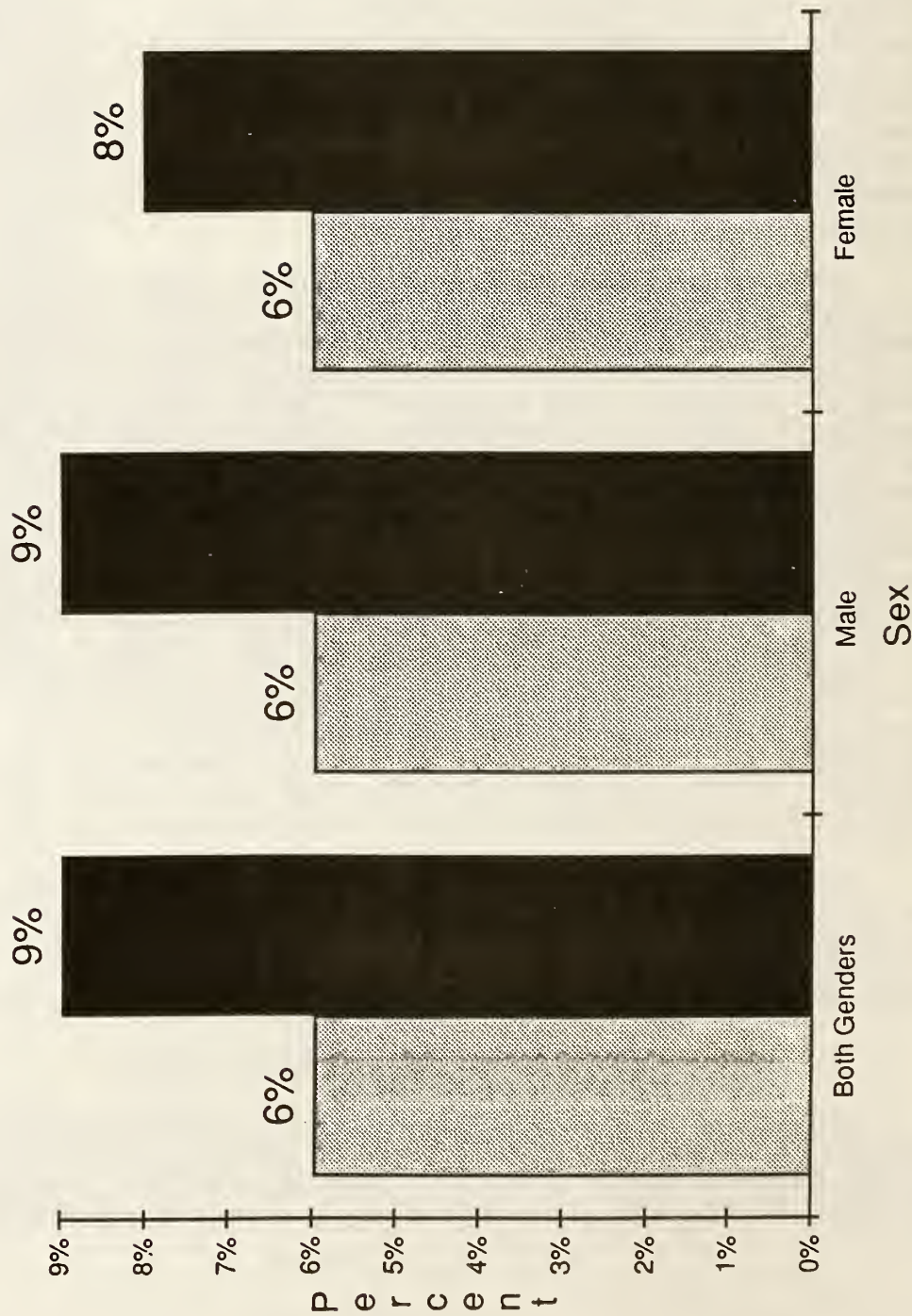
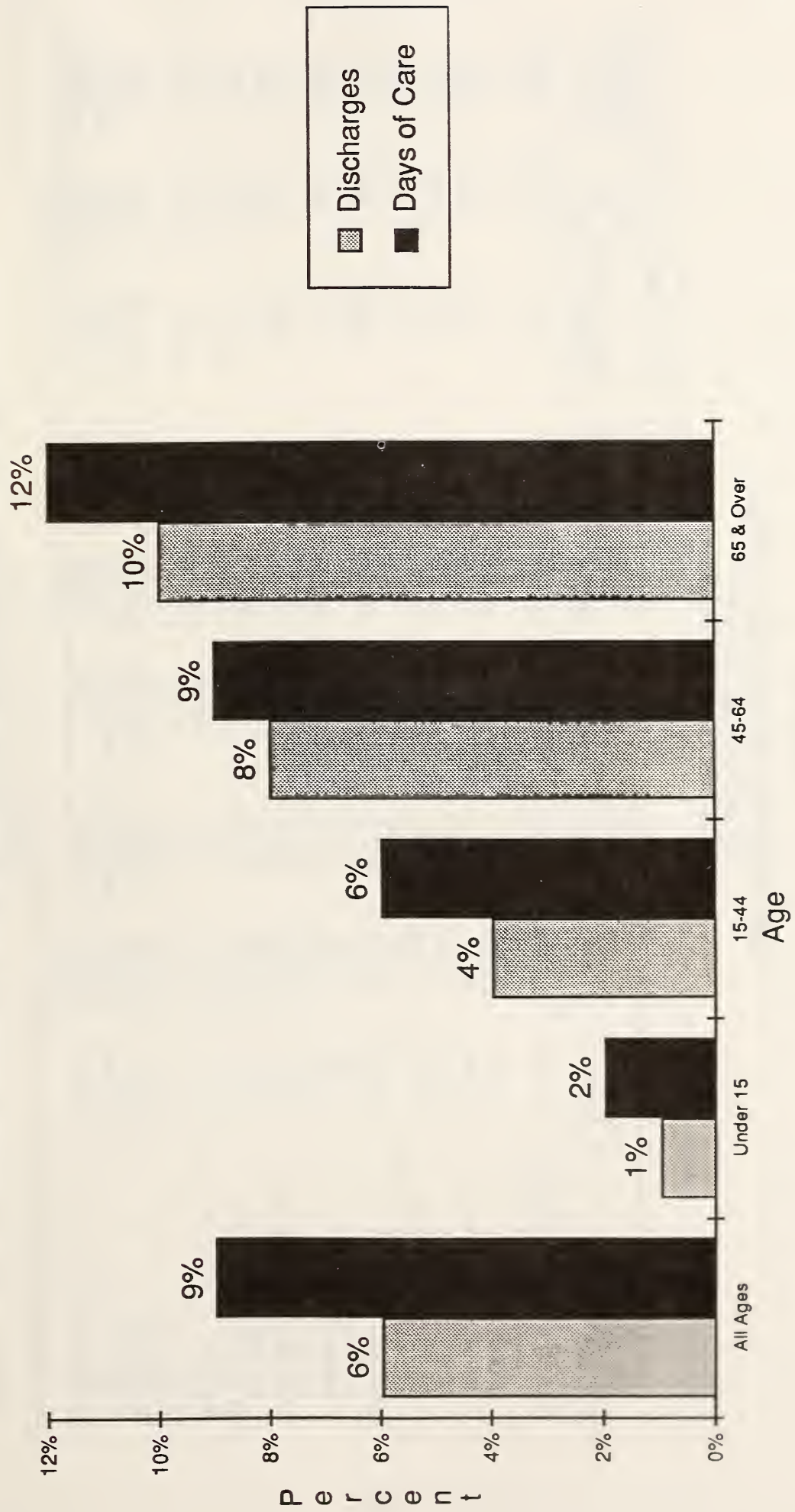


Figure 10

Percent of Discharges and Days of Care with
Secondary ADM Diagnoses by Age, 1984-1986



Source: National Hospital Discharge Survey

Table 11

ADM COMORBIDITY IN SHORT-STAY HOSPITALS
BY AGE AND SEX, 1984-86
(Three-Year Annual Average)

Age and Sex	Total [1]			No Secondary ADM Diagnoses [1]			With Secondary ADM Diagnoses [1]		
	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay
Total	37,421	221,742	5.93	35,218	202,807	5.76	2,203	18,935	8.60
Under 15	6,711	26,404	3.93	6,644	25,925	3.90	67	479	7.15
15-44	12,894	55,337	4.29	12,353	51,792	4.19	541	3,545	6.55
45-64	7,262	48,997	6.75	6,718	44,564	6.63	544	4,433	8.15
65 and Over	10,554	91,004	8.62	9,503	80,526	8.47	1,051	10,478	9.97
Male	15,313	95,006	6.20	14,354	86,790	6.05	959	8,216	8.57
Under 15	3,637	14,349	3.95	3,600	14,088	3.91	37	261	7.05
15-44	3,577	18,574	5.19	3,331	16,846	5.06	246	1,728	7.02
45-64	3,536	23,655	6.69	3,263	21,483	6.58	273	2,172	7.96
65 and Over	4,563	38,428	8.42	4,160	34,373	8.26	403	4,055	10.06
Female	22,108	126,736	5.73	20,864	116,017	5.56	1,244	10,719	8.62
Under 15	3,074	12,055	3.92	3,044	11,837	3.89	30	218	7.27
15-44	9,317	36,763	3.95	9,022	34,946	3.87	295	1,817	6.16
45-64	3,726	25,342	6.80	3,455	23,081	6.68	271	2,261	8.34
65 and Over	5,991	52,576	8.78	5,343	46,153	8.64	648	6,423	9.91

[1] Excludes discharges with a primary ADM diagnosis.

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

Table 12

ADM COMORBIDITY IN SHORT-STAY HOSPITALS
BY DIAGNOSIS AND SEX, 1984-86
(Three-Year Annual Average)

Diagnosis	Total			Males			Females		
	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay
Total[1]	37,421	221,742	5.93	15,313	95,006	6.20	22,108	126,736	5.73
No Secondary ADM[1]	35,218	202,807	5.76	14,354	86,790	6.05	20,864	116,017	5.56
With Secondary ADM[1]	2,203	18,935	8.60	959	8,216	8.57	1,244	10,719	8.62
Alcohol Abuse	235	2,017	8.58	174	1,469	8.44	61	548	8.98
Drug Abuse	471	3,216	6.82	211	1,473	6.98	260	1,743	6.70
Mental Illness	1,369	12,658	9.25	506	4,744	9.38	863	7,914	9.17
Alcohol & Drug Abuse	26	183	7.04	20	144	7.20	6*	39*	6.50*
Alcohol & Mental Illness	30	269	8.97	20	168	8.40	10	101	10.10
Drug Abuse & Mental Illness	67	565	8.43	25	201	8.04	42	364	8.67
Alcohol & Drug Abuse & Mental Illness	5*	27*	5.40*	3*	17*	5.67*	2*	10*	5.00*

* Figure has low statistical reliability or precision (relative standard error exceeds 30 percent).

[1] Excludes discharges with a primary ADM diagnosis.

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

Table 13

ADM COMORBIDITY IN SHORT-STAY HOSPITALS
BY SECONDARY ADM DIAGNOSIS AND AGE, 1984-86
(Three-Year Annual Average)

Secondary ADM* Diagnoses	Total			Under 65			65 & Over		
	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay
Total[1]	37,421	221,742	5.93	26,867	130,738	4.87	10,554	91,004	8.62
No Secondary ADM[1]	35,218	202,807	5.76	25,715	122,281	4.76	9,503	80,526	8.47
With Secondary ADM[1]	2,203	18,935	8.60	1,152	8,457	7.34	1,051	10,478	9.97
Alcohol Abuse	235	2,017	8.58	173	1,385	8.01	62	632	10.19
Drug Abuse	471	3,216	6.82	296	1,835	6.20	175	1,381	7.89
Mental Illness	1,369	12,658	9.25	596	4,578	7.68	773	8,080	10.45
Alcohol & Drug Abuse	26	183	7.04	22	154	7.00	4*	29*	7.25*
Alcohol & Mental Illness	30	269	8.97	21	163	7.76	9*	106*	11.78*
Drug Abuse & Mental Illness	67	565	8.43	40	321	8.03	27*	244*	9.04*
Alcohol & Drug Abuse & Mental Illness	5*	27*	5.40*	4*	21*	5.25*	1*	6*	6.00*

* Figure has low statistical reliability or precision (relative standard error exceeds 30 percent).

[1] Excludes discharges with a primary ADM diagnosis.

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

women -- 11.3 days compared with 12.4 days. Almost three-fifths of the 1.9 million discharges are in the 15-44 age group.

The ADM comorbidity rate is very high for hospitalizations with a primary ADM diagnosis. Of the 1.9 million discharges, almost half (46 percent) have a secondary ADM diagnosis. The average length of stay with and without secondary ADM diagnoses are almost equal -- 12.0 days and 11.7 days, respectively. Thus, 46 percent of the 22.1 million ADM days of care are for hospitalizations with a secondary ADM discharge.

Men with a primary ADM diagnosis are somewhat more likely than women to have a comorbid ADM diagnosis -- 49 percent compared with 42 percent. The highest rate of ADM comorbidity is for the 15-44 age group; more than half the discharges in this age group report a secondary ADM diagnosis.

Of the total 1.9 million discharges, 61 percent have a primary diagnosis of mental illness, 27 percent are alcohol abuse discharges, the remaining 12 percent are drug abuse discharges (Table 15). The rate of ADM comorbidity varies by diagnosis. About 60 percent of the discharges with primary diagnoses of alcohol abuse and drug abuse report secondary ADM diagnoses. By contrast, only 37 percent of the mental illness discharges report ADM comorbidity.

Overlap of ADM Discharges

As indicated above, alcohol abuse, drug abuse, and mental illness are not independent disorders. To measure the extent of overlap of these disorders among hospitalized patients, Table 16 distributes the short-stay hospital discharges with each primary diagnosis of alcohol, drug, and mental disorder by the reported secondary ADM diagnosis. For the 504,000 discharges with a primary diagnosis of alcohol abuse, 73 percent (369,000 or 203,000 with no secondary ADM diagnosis plus 166,000 with a secondary alcohol abuse diagnosis) do not report any overlap with other ADM categories. For drug abuse, 56 percent (126,000 or 95,000 plus 31,000) of the 224,000 discharges report no overlap.

By far the highest proportion (88 percent -- 1,009,000 or 293,000 plus 716,000) of the 1,143,000 discharges with a primary diagnosis of mental illness report no overlap with other ADM diagnoses. Table 17 summarizes the magnitude of ADM overlap for the total 1.9 million discharges with a primary diagnosis of ADM. In total, about four-fifths of the discharges and of the days of care do not report any overlap among alcohol abuse, drug abuse, and mental illnesses. The highest degree of overlap for hospitalized ADM patients, 6.8 percent of the discharges, are combinations of drug abuse and mental illness. Alcohol and mental illness represent 6.2 percent of the total, and alcohol and drug abuse account for 4.1 percent of the total. Only 44,000 discharges report overlap between alcohol, drug abuse, and mental illness and their length of stay is 13.5 days. In combining these comorbid categories, we assume, in effect, that the ADM diagnoses are equally responsible for the recorded illnesses, utilization, and resulting costs.

ADM Short-Stay Hospital Costs

To estimate the costs of ADM short-stay hospital care, annual expenses per patient day in all non-federal community hospitals, as reported by the

Table 14

ADM COMORBIDITY OF SHORT-STAY HOSPITAL DISCHARGES
WITH PRIMARY ADM DIAGNOSES BY AGE AND SEX, 1984-86
(Three-Year Annual Average)

Age and Sex	Total			No Secondary ADM Diagnoses			With Secondary ADM Diagnoses		
	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay
Total	1,871	22,140	11.83	1,014	11,888	11.72	857	10,252	11.96
Under 15	75	1,244	16.59	53	723	13.64	22	521	23.68
15-44	1,086	12,577	11.58	538	6,109	11.36	548	6,468	11.80
45-64	439	4,996	11.38	243	2,902	11.94	196	2,094	10.68
65 and Over	263	3,331	12.67	174	2,159	12.41	89	1,172	13.17
Male	994	11,250	11.32	506	5,744	11.35	488	5,506	11.28
Under 15	40	738	18.45	31	442	14.26	9*	296*	32.89*
15-44	606	6,871	11.34	288	3,241	11.25	318	3,630	11.42
45-64	233	2,390	10.26	117	1,301	11.12	116	1,089	9.39
65 & Over	107	1,256	11.74	66	763	11.56	41	493	12.02
Female	879	10,896	12.40	508	6,145	12.10	371	4,751	12.81
Under 15	31	500	16.13	22	276	12.55	9*	224*	24.89*
15-44	479	5,708	11.92	250	2,868	11.47	229	2,840	12.40
45-64	203	2,608	12.85	125	1,602	12.82	78	1,006	12.90
65 and Over	157	2,071	13.19	108	1,392	12.89	49	679	13.86

* Figure has low statistical reliability or precision (relative standard error exceeds 30 percent).

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

NOTE: Numbers may not add to totals due to rounding.

Table 15

ADM COMORBIDITY OF SHORT-STAY HOSPITAL ADM DISCHARGES
BY DIAGNOSIS AND SEX, 1984-86
(Three-Year Annual Average)

Diagnosis And Sex	Total			No Secondary ADM Diagnoses			With Secondary ADM Diagnoses		
	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay
Total	1,871	22,140	11.83	1,014	11,888	11.72	857	10,252	11.96
Alcohol Abuse	504	5,017	9.95	203	2,019	9.95	301	2,998	9.96
Drug Abuse	224	1,970	8.79	95	733	7.72	129	1,237	9.59
Mental Illness	1,143	15,153	13.26	716	9,136	12.76	427	6,017	14.09
Male	994	11,250	11.32	506	5,744	11.35	488	5,506	11.28
Alcohol Abuse	386	3,736	9.68	156	1,538	9.86	230	2,198	9.56
Drug Abuse	133	1,187	8.92	59	444	7.53	74	743	10.04
Mental Illness	475	6,327	13.32	291	3,762	12.93	184	2,565	13.94
Female	879	10,896	12.40	508	6,145	12.10	371	4,751	12.81
Alcohol Abuse	120	1,282	10.68	48	481	10.02	72	801	11.13
Drug Abuse	91	786	8.64	35	289	8.26	56	497	8.88
Mental Illness	668	8,828	13.22	425	5,375	12.65	243	3,453	14.21

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

Table 16

ADM OVERLAP OF SHORT-STAY HOSPITAL ADM DISCHARGES
BY DIAGNOSIS, 1984-86
(Three-Year Annual Average)

Diagnosis	Primary Diagnosis								
	Alcohol Abuse			Drug Abuse			Mental Illness		
	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay	Discharges (000's)	Days of Care (000's)	Average Length of Stay
Total	504	5,017	9.95	224	1,970	8.79	1,143	15,153	13.26
No Secondary ADM	203	2,019	9.95	95	733	7.72	716	9,136	12.76
With Secondary ADM	301	2,998	9.96	129	1,237	9.59	427	6,017	14.09
Alcohol Abuse	166	1,323	7.97	19	220	11.58	32	381	11.91
Drug Abuse	40	571	14.28	31	266	8.58	41	520	12.68
Mental Illness	40	440	11.00	46	358	7.78	293	4,178	14.26
Alcohol & Drug Abuse	12	139	11.58	9*	143*	15.89*	8*	111*	13.88*
Alcohol & Mental Illness	24	273	11.38	8*	92*	11.50*	19	276	14.53
Drug Abuse & Mental Illness	13	190	14.62	13	122	9.38	28	449	16.04
Alcohol & Drug Abuse & Mental Illness	6*	62*	10.33*	3*	36*	12.00*	6*	102*	17.00*

* Figure has low statistical reliability or precision (relative standard error exceeds 30 percent).

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

American Hospital Association (1987), is used. For 1985, this amounts to \$459.73. This figure is applied to the 22.1 million days of care associated with a primary diagnosis of ADM shown in Tables 14 and 15, yielding a cost of \$10.2 billion in 1985 (Table 18). The number of discharges with secondary ADM diagnoses (2.2 million) times the difference in length of stay between those with and without ADM diagnoses (2.84 days), yields a measure of additional utilization of 6.3 million days at a cost of \$2.9 billion.

Because hospital costs of ADM are based on days of care attributable to the primary and secondary ADM diagnoses, overlap does not add to the total amount of expenditures attributable to ADM. Table 19, however, indicates the significance of the adjustment for overlap in distributing hospital costs among alcohol, drug, and mental illness diagnoses. As is evident from the table, the adjustment redistributes approximately \$100 million each from alcohol abuse and mental illness to drug abuse, raising its share by over \$200 million.

The total ADM cost in short-stay hospitals is estimated at \$13.1 billion for 1985 (Figure 11). Of this total, almost four-fifths (78 percent) are short-stay hospital costs of care for patients with primary ADM diagnoses and more than one-fifth (22 percent) represents hospital expenditures attributed to ADM comorbidity. Of the total \$13.1 billion, 67.4 percent is for hospital costs for patients with mental illness, 23.1 percent for alcohol abuse costs, and 9.5 percent for drug abuse costs.

The distribution of the \$13.1 billion by gender shows an almost equal amount for men and women, 49 percent and 51 percent, respectively (Table 20 and Figure 12). The 15-44 age groups account for half the total costs, and the 45-64 and the 65 and over age groups account for 23 percent and 22 percent, respectively (Figure 13). Only 5 percent of the ADM short-stay hospital costs are for patients under age 15.

Discussion

The foregoing analysis provides an estimate of \$13.1 billion for the inpatient costs of alcohol and drug abuse and mental illness in U.S. short-term general hospitals for 1985. There are a number of reasons to believe that this is a conservative estimate. First, hospital discharge records may not list ADM secondary conditions for all primary diagnoses known to be associated with alcohol consumption.

According to a recent NIAAA study (1989), a total of 594,234 discharges are reported in 1985 have first listed alcohol-related diagnoses, of which 60,167 discharges are in the diagnostic categories listed below and not included in our study. We report 504,000 discharges (see Table 16) with a primary diagnosis of alcohol abuse (see Appendix A for a list of the diagnoses included in our study). Thus, our estimates may be understated by about 11 percent. The NIAAA (1989) study of hospital discharges with alcohol-related conditions includes the following diagnostic categories not included as a primary ADM diagnosis in our study.

Table 17

SUMMARY OF ADM OVERLAP IN SHORT-STAY HOSPITALS
BY DIAGNOSIS, 1984-86
(Three-Year Annual Average)

Primary ADM Diagnosis	Discharges		Days of Care		Average Length of Stay
	Number (000's)	Percent Distribution	Number (000's)	Percent Distribution	
Total	1,871	100.0	22,140	100.0	11.83
Alcohol Abuse	369	19.7	3,342	15.1	9.06
Drug Abuse	126	6.7	999	4.5	7.93
Mental Illness	1,009	53.9	13,314	60.1	13.20
Alcohol & Drug Abuse	80	4.3	1,073	4.9	13.41
Alcohol & Mental Illness	115	6.2	1,370	6.2	11.91
Drug Abuse & Mental Illness	128	6.8	1,449	6.5	11.32
Alcohol, Drug Abuse & Mental Illness	44	2.4	593	2.7	13.48

SOURCE: National Hospital Discharge Survey, 1984-86; original tabulations from public use tapes.

Table 18

ADM SHORT-STAY HOSPITAL COSTS BY TYPE OF COST, 1985

<u>Type of Cost</u>	<u>Amount (millions)</u>		
	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u> <u>Mental Illness</u>
Total	\$13,064	\$3,017	\$1,242
ADM Primary Diagnosis	10,178	2,306	906
Comorbidity	2,886	711	336
<u>Percent Distribution by Type of Cost</u>			
Total	100.0	100.0	100.0
ADM Primary Diagnosis	77.9	76.4	72.9
Comorbidity	22.1	23.6	27.1
<u>Percent Distribution by Diagnosis</u>			
Total	100.0	23.1	9.5
ADM Primary Diagnosis	100.0	22.7	8.9
Comorbidity	100.0	24.6	11.7

Table 19

DISTRIBUTION OF ADM DISCHARGES, DAYS AND
COSTS, WITH AND WITHOUT CORRECTION FOR OVERLAP

	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Discharges (000's)				
By Primary Diagnosis	1,871	504	224	1,143
Adjusted for Overlap	1,871	481	245	1,145
Days of Care (000's)				
By Primary Diagnosis	22,140	5,017	1,970	15,153
Adjusted for Overlap	22,140	4,761	2,458	14,921
Costs (millions)				
By Primary Diagnosis	\$10,178	\$2,306	\$906	\$6,966
Adjusted for Overlap	10,178	2,189	1,130	6,859

Table 20

ADM SHORT-STAY HOSPITAL COSTS BY AGE AND SEX, 1985
(millions)

<u>Age and Sex</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Total	\$13,064	\$3,017	\$1,242	\$8,805
Under 15	664	34	33	600
15-44	6,499	1,515	815	4,167
45-64	3,011	936	190	1,885
65 and Over	2,890	534	204	2,154
Male	6,429	2,206	713	3,510
Under 15	390	24	16	350
15-44	3,483	1,136	511	1,836
45-64	1,454	681	99	674
65 and Over	1,102	365	87	650
Female	6,635	811	529	5,295
Under 15	274	10	17	247
15-44	3,016	379	304	2,333
45-64	1,557	255	91	1,211
65 and Over	1,788	167	117	1,504

Figure 11

ADM Short-Stay Hospital Costs by Type of Cost and Disorder, 1985

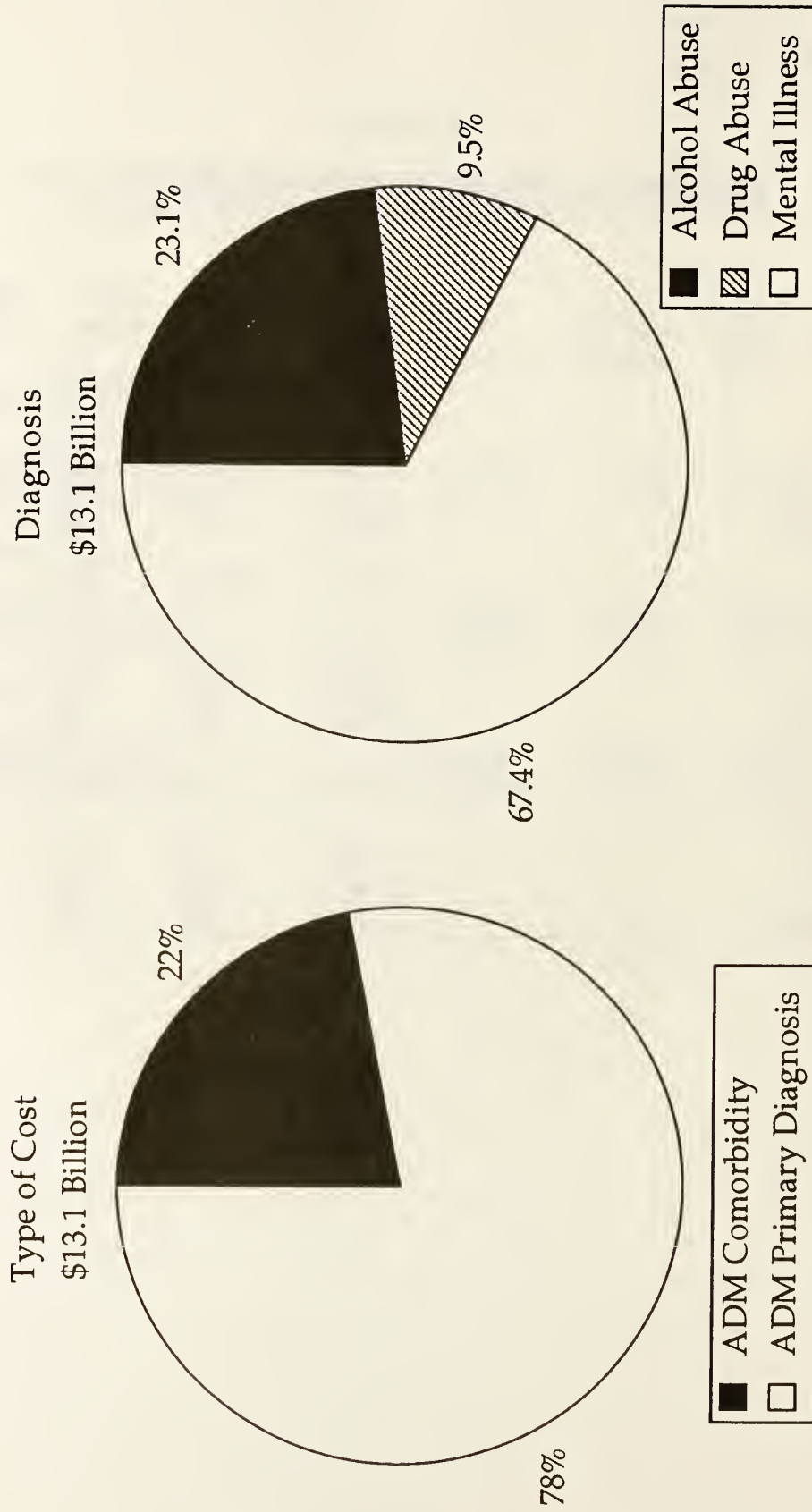
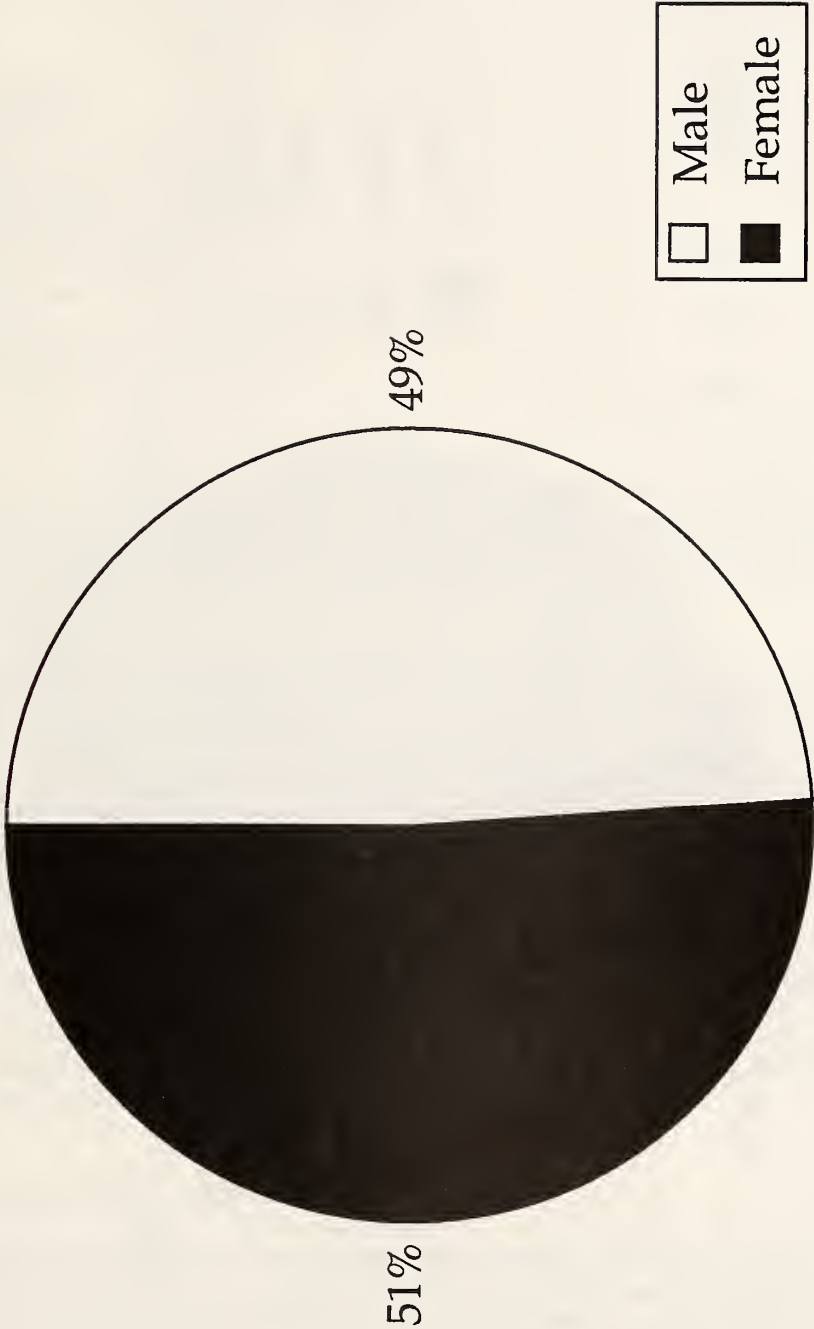


Figure 12

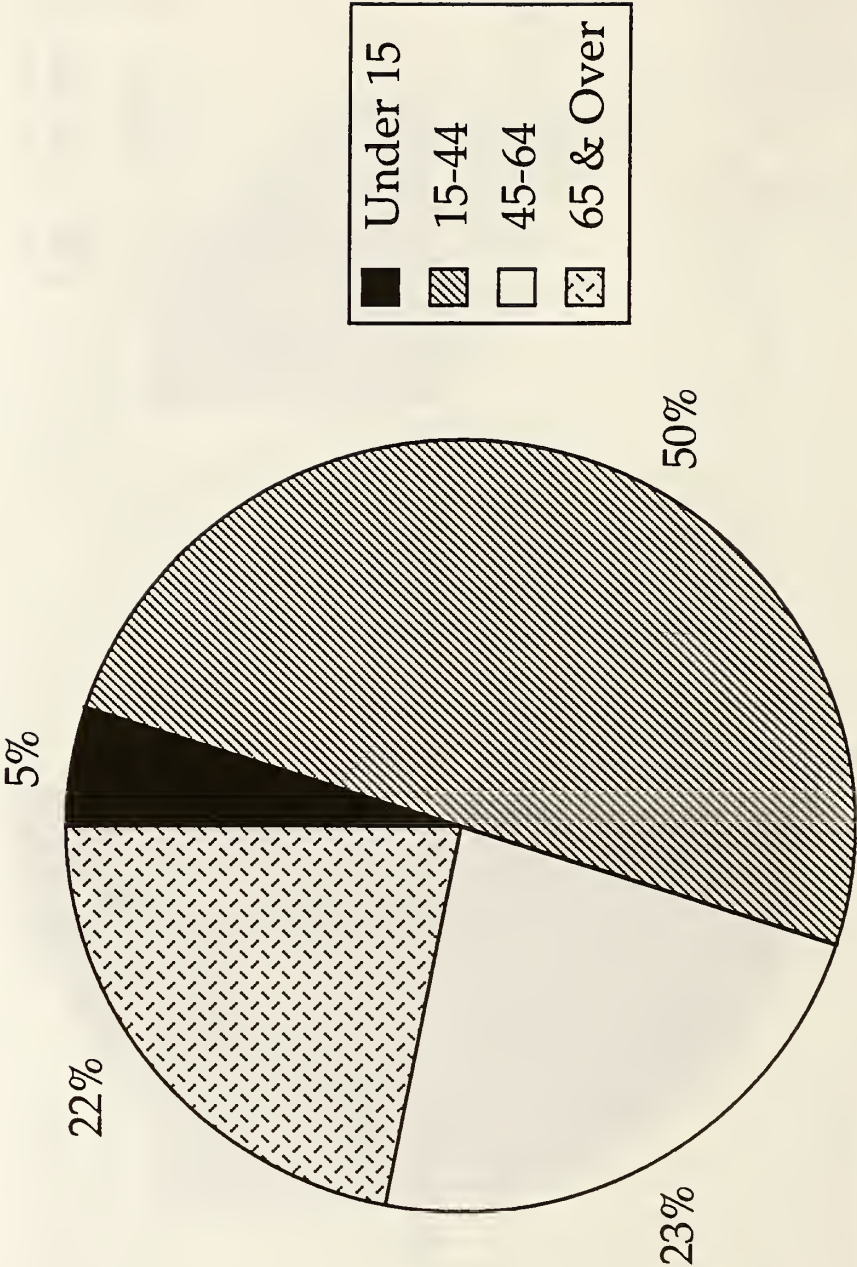
ADM Short-Stay Hospital Costs by Sex, 1985



\$13.1 Billion

Figure 13

ADM Short-Stay Hospital Costs by Age, 1985



\$13.1 Billion

Diagnoses Not Included in this Report as Primary ADM Diagnoses

<u>Diagnosis</u>	<u>ICD-9-CM Code</u>
Pellagra	265.2
Chronic hepatitis	571.4
Biliary cirrhosis	771.6
Other chronic nonalcoholic liver	571.8
Portal hypertension disease in "liver abscess and sequelae of chronic liver disease"	572.3
Cirrhosis of liver without mention of alcohol	571.5
Unspecified chronic liver disease without mention of alcohol	571.9

With regard to alcoholism as a comorbid condition, NIAAA estimates are only 2 percent higher than those in this study – 516,000 compared with 504,000 (296,000 secondary alcohol abuse discharges for non-ADM primary discharges from Table 13 plus 208,000 secondary alcohol abuse discharges for primary ADM discharges from Table 16).

The comorbidity estimates may also be underestimated because the value attributed to them is that of the ADM comorbid excess length of stay associated with non-ADM discharges. No attempt is made to estimate the effect of ADM comorbidity on inpatient admissions. To the degree that the admission rates for non-ADM disorders among the ADM-prevalent population is greater than those among the non-ADM-prevalent population, and are not taken into account herein, the comorbid inpatient costs of ADM disorders are underestimated.

The above sources of underestimation may be offset by the use of the average expenses per patient day in all non-federal community hospitals as reported by the American Hospital Association. Since ADM short-stay hospital episodes do not involve surgery, the average expenses per day for ADM patients is probably less than for the average patient. Consequently, use of the average annual expense per day is likely to overestimate the costs.

OTHER TREATMENT AND SUPPORT COSTS

Other treatment and support costs for ADM patients include the costs of care given by specialty institutions, federal providers (Veterans Administration, Army, Navy, and Air Force, and Indian Health Affairs), and nursing homes. Also included are the costs of ambulatory care for ADM patients, that is, office-based physicians, other professional services, and drugs. Finally, research, training, program administration, and net cost of private insurance related to treatment of ADM disorders are also included in this cost category.

ADM other treatment and support costs are estimated at \$33.5 billion, of which \$29.4 billion, 88 percent, is for the mentally ill (Table 21). The costs of care in organized mental health settings account for almost two-fifths of the \$29.4 billion; care of the mentally ill accounts for one-fifth of this total. The cost

Table 21

ADM OTHER TREATMENT AND SUPPORT COSTS
BY TYPE OF COST, 1985

<u>Type of Cost</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
	<u>Amount (millions)</u>			
Total	\$38,356	\$3,793	\$840	\$33,723
ADM and Federal Institutions	15,682	2,281	570	12,831
Nursing Homes	11,286	703	-	10,583
Office-Based Physicians	2,344	141	52	2,151
Other Professional Services	3,656	173	17	3,466
Drugs	1,453	-	-	1,453
Support Costs	3,935	495	201	3,239
	<u>Percent Distribution</u>			
Total	100.0	100.0	100.0	100.0
ADM Specialty Institutions	40.9	60.1	67.9	38.0
Nursing Homes	29.4	18.5	-	31.4
Office-Based Physicians	6.1	3.7	6.2	6.4
Other Professional Services	9.5	4.6	2.0	10.3
Drugs	3.8	-	-	4.3
Support Costs	10.3	13.1	23.9	9.6

estimates, sources of data, and estimating procedure for each category of expenditure are presented below.

ADM Specialty Institutions

ADM specialty institutions are organized settings in which services are provided primarily or exclusively for the treatment of ADM disorders. Three broad categories of institution are presented in Table 22, namely, state and county psychiatric hospitals, private psychiatric hospitals, and other ADM specialty institutions. The latter include residential treatment centers for emotionally disturbed children, freestanding alcohol, drug and mental health care organizations, multi-service mental health organizations, and correctional facilities. Also included in the totals for this category are federal providers, although they are discussed separately.

Expenditures for care in ADM specialty institutions and federal facilities amount to \$15.7 billion, of which \$5.7 billion (36 percent) is for care in state and county psychiatric hospitals, \$1.9 billion (12 percent) for care in private psychiatric hospitals, \$5.9 billion (37 percent) for care in the other ADM specialty institutions listed above, and \$2.3 billion (14 percent) for care in federal facilities. Of the total \$15.7 billion, 85 percent is the cost of care for mental illness, 12 percent for alcohol abuse, and the remaining 3 percent for drug abuse. The sources of data are described below.

Total expenditures for state and county and private psychiatric hospitals (\$5.7 billion) are provided in *Specialty Mental Health Organizations in the United States*, 1985 (NIMH, 1988b). Expenditures for other ADM specialty institutions (\$5,860 million) are provided in several reports of the three Institutes within ADAMHA (NIMH 1988b; NIAAA, 1983; and NIDA, 1983). Included are residential treatment centers (\$652 million), freestanding facilities (\$402 million), and other partial care and multiservice mental health organizations (\$3.2 billion), for a total of \$4.3 billion.

Expenditures for care in other alcohol facilities (\$1.3 billion) and drug facilities (\$273 million) are estimated as follows: a total of \$1.1 billion is reported for expenditures in approximately 4,200 units surveyed in the 1982 National Drug and Alcoholism Treatment Unit Survey (NIAAA, 1983); similarly, \$533 million is spent in approximately 3,000 drug abuse only or alcohol and drug abuse treatment units (NIDA, 1983).

Using data on numbers of units and numbers of drug and alcohol clients in alcohol only, drug only, and alcohol and drug units, unduplicated expenditures of \$1.1 billion in alcohol treatment costs and \$212 million in drug treatment costs are derived. Deducting from those two totals the amounts included in short-stay hospitals (Chapter III) results in net expenditures of \$1.0 billion for alcohol and \$208 million for drugs in 1982. Applying an inflation factor taken from the rate of growth in personal health care expenditures from 1982-1985 (1.313) results in other specialty treatment costs of \$1.3 billion for alcohol and \$273 million for drugs.

The distribution by age of the total costs of care in specialty institutions (Table 23) is based on unpublished age and sex distributions of the number of resident patients in state and county mental hospitals provided by the Division of Epidemiology and Biometry, NIMH. Expenditures for care for the 25-44 age

Table 22

COSTS OF CARE IN ADM AND FEDERAL INSTITUTIONS
BY TYPE OF INSTITUTION, 1985

<u>Type of Institution</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
<u>Amount (millions)</u>				
Total	\$15,682	\$2,281	\$570	\$12,831
Federal Providers	2,273	664	176	1,433
State and County Psychiatric Hospitals	5,661	215	91	5,355
Private Psychiatric Hospitals	1,888	72	30	1,786
Other ADM Institutions	5,860	1,330	273	4,257
<u>Percent Distribution</u>				
Total	100.0	100.0	100.0	100.0
Federal Providers	14.5	29.1	30.9	11.2
State and County Psychiatric Hospitals	36.1	9.4	16.0	41.7
Private Psychiatric Hospitals	12.0	3.2	5.3	13.9
Other ADM Institutions	37.4	58.3	47.9	33.2

Table 23

COSTS OF CARE IN ADM SPECIALTY INSTITUTIONS
BY AGE AND SEX, 1985
(millions)

<u>Age and Sex</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Total	\$13,409	\$1,617	\$394	\$11,398
Under 18	694	15	34	645
18-24	1,398	173	115	1,110
25-44	5,450	576	206	4,668
45-64	3,075	496	26	2,553
65 and Over	2,792	357	13	2,422
Male	8,237	1,273	306	6,658
Under 18	460	10	23	427
18-24	1,026	143	93	790
25-44	3,841	468	165	3,208
45-64	1,651	383	18	1,250
65 and Over	1,259	269	7	983
Female	5,172	344	88	4,740
Under 18	234	5	11	218
18-24	372	30	22	320
25-44	1,609	108	41	1,460
45-64	1,424	113	8	1,303
65 and Over	1,533	88	6	1,439

* Excludes care provided in federal institutions.

Table 24

ADM COSTS OF CARE BY FEDERAL PROVIDERS, 1985

<u>Agency</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
	<u>Amount (millions)</u>			
Total	\$2,273	\$664	\$176	\$1,433
Veterans Administration	1,190	188	73	929
Other*	1,083	476	103	504
	<u>% Distribution by Agency</u>			
Total	100.0	100.0	100.0	100.0
Veterans Administration	52.4	28.3	41.5	64.8
Other*	47.6	71.7	58.5	35.2
	<u>% Distribution by ADM Disorder</u>			
Total	100.0	29.2	7.8	63.0
Veterans Administration	100.0	15.8	6.1	78.1
Other*	100.0	44.0	9.5	46.5

* Includes Army, Navy, Airforce, and Indian Health Service.

group are highest, accounting for two-fifths of the total. Almost one-quarter of the total is for care of persons aged 45-64 and one-fifth for care of the elderly in these institutions. Men account for three-fifths (61 percent) of the costs and women for 39 percent of the costs in ADM specialty institutions.

Federal Providers

The federal provider category includes amounts spent for care of patients with ADM disorders by the Veterans Administration (VA); the Army, Navy, and Air Force; and the Indian Health Service. The total is estimated at \$2.3 billion, distributed as follows: alcohol abuse -- \$664 million; drug abuse -- \$176 million; and mental illness -- \$1.4 billion (see Table 24).

Of the total \$2.3 billion, \$1.2 billion, or 52 percent, is spent in VA general hospitals and other facilities (R.P. Suchinsky, M.D., Dept. of Medicine and Surgery, Veterans Administration, personal communication, 1988). The remaining \$1.1 billion is the estimated amount spent by the Armed Forces and the Indian Health Service. This estimate is obtained by inflating the amounts estimated by RTI (Harwood et al., 1984) for 1980 (\$632 million) by the rate of increase between 1980 and 1985 of the personal health care expenditures (U.S. HCFA, 1987). The distribution by ADM disorder is based on the distribution of 1980 expenditures for these services.

Nursing Home Costs

Expenditures for nursing home care for residents with diagnoses of mental illness and alcoholism are estimated at \$11.3 billion, or one-third, 32.6 percent of the total expenditures for nursing home care in 1985. The distribution of residents and costs by age and sex is shown in Table 25. Of the total \$11.3 billion, \$10.6 billion represents expenditures for residents with mental disorders; the remaining \$703 million is for residents with a diagnosis of alcoholism.

Almost 9 out of 10 residents with diagnoses of mental illness and alcoholism are aged 65 and over. The age and sex distribution of the number of residents and of costs are the same because a flat charge of \$17,472 is applied to the number of residents regardless of age, sex, or diagnosis. Almost 72 percent of nursing home residents are women, and 40 percent are aged 85 and over.

The number of nursing home residents is from the 1985 National Nursing Home Survey conducted by the National Center for Health Statistics (NCHS, 1989). The distribution by diagnosis is based on the number of residents distributed by all-listed diagnoses at admission. A total of 645,900 residents, 43 percent of the total, are listed with mental disorders. Half of the "other mental disorders," or a total of 40,200 residents, are classified as alcoholism disorders. The assumption is made that the diagnostic distribution of residents at admission represents the distribution throughout the year.

The annual charge of \$17,472 is applied to the number of residents to estimate total expenditures. This annual charge is estimated from the average annual monthly charge of \$1,456 reported for all residents in the 1985 National Nursing Home Survey (NCHS, 1989, Table 19).

Table 25

ADM NURSING HOME RESIDENTS AND COSTS BY AGE AND SEX, 1985

<u>Age and Sex</u>	<u>Number of Residents</u>			<u>Costs (millions)</u>		
	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Mental Illness</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Mental Illness</u>
Total	645,900	40,200	605,700	\$11,286	\$703	\$10,583
Under 65	74,924	4,663	70,261	1,309	81	1,228
65 and Over	570,976	35,537	535,439	9,997	622	9,355
65-74	91,928	5,722	86,206	1,607	101	1,506
75-84	220,968	13,753	207,215	3,861	240	3,621
85 and Over	258,080	16,062	242,018	4,509	281	4,228
Male	183,500	11,421	172,079	3,207	200	3,007
Under 65	21,286	1,325	19,961	372	23	349
65 and Over	162,214	10,096	152,118	2,835	177	2,658
65-74	26,117	1,626	24,491	457	29	428
75-84	62,777	3,907	58,870	1,097	68	1,029
85 and Over	73,320	4,563	68,757	1,281	80	1,201
Female	462,400	28,779	433,621	8,079	503	7,576
Under 65	53,638	3,338	50,300	937	58	879
65 and Over	408,762	25,441	383,321	7,142	445	6,697
65-74	65,811	4,096	61,715	1,150	72	1,078
75-84	158,191	9,846	148,345	2,764	172	2,592
85 and Over	184,760	11,499	173,261	3,228	201	3,027

SOURCE: 1985 National Nursing Home Survey (NCHS, 1989).

TABLE 26

**ADM VISITS TO ALL OFFICE-BASED
PHYSICIANS AND TO PSYCHIATRISTS
BY AGE, SEX, AND DIAGNOSIS, 1985**

Age and Sex	Total (thousands)	Psychiatrists	
		Number (thousands)	Percent (of Total)
<i>Total</i>	33,451	17,990	53.8
<i>Under 15</i>	1,714	821	47.9
<i>15-24</i>	2,937	1,730	58.9
<i>25-44</i>	14,874	10,114	68.0
<i>45-64</i>	8,905	4,150	46.6
<i>65 & Over</i>	5,021	1,175	23.4
<i>Male</i>	12,406	7,309	58.9
<i>Under 15</i>	1,010	541	53.6
<i>15-24</i>	1,084	737	68.0
<i>25-44</i>	6,002	4,246	70.7
<i>45-64</i>	2,788	1,451	52.0
<i>65 & Over</i>	1,522	334	21.9
<i>Female</i>	21,045	10,681	50.8
<i>Under 15</i>	704	280	39.8
<i>15-24</i>	1,853	993	53.6
<i>25-44</i>	8,872	5,868	66.1
<i>45-64</i>	6,117	2,699	44.1
<i>65 & Over</i>	3,499	841	24.0

SOURCE: National Ambulatory Care Survey, 1985;
original tabulations from public use tapes.

TABLE 27

**ADM VISITS TO OFFICE-BASED PHYSICIANS
BY AGE, SEX, AND DIAGNOSIS, 1985**

Age and Sex	(thousands)			
	Total	Alcohol Abuse	Drug Abuse	Mental Illness
<i>Total</i>	33,451	504	125	32,821
<i>Under 15</i>	1,714	58	4	1,652
<i>15-24</i>	2,937	39	22	2,877
<i>25-44</i>	14,874	156	25	14,694
<i>45-64</i>	8,905	221	65	8,619
<i>65 & Over</i>	5,021	31	10	4,980
<i>Male</i>	12,406	273	80	12,053
<i>Under 15</i>	1,010	20	0	990
<i>15-24</i>	1,084	2	15	1,068
<i>25-44</i>	6,002	115	17	5,871
<i>45-64</i>	2,788	116	46	2,627
<i>65 & Over</i>	1,522	21	3	1,498
<i>Female</i>	21,045	232	46	20,768
<i>Under 15</i>	704	38	4	662
<i>15-24</i>	1,853	37	7	1,809
<i>25-44</i>	8,872	41	8	8,823
<i>45-64</i>	6,117	106	20	5,992
<i>65 & Over</i>	3,499	10	7	3,482

SOURCE: National Ambulatory Care Survey, 1985; original tabulations from public use tapes.

Office-Based Physicians

The cost of care for persons with ADM disorders provided by office-based physicians, including psychiatrists, is estimated at \$2.3 billion, of which \$2.2 billion (92 percent) is for care of the mentally ill, \$141 million for alcohol abuse, and \$52 million for drug abuse.

These cost estimates are based primarily on visit data from the 1985 National Ambulatory Care Survey (NAMCS) conducted by the National Center for Health Statistics. The 1985 NAMCS is a sample survey of office-based physicians, including psychiatrists, principally engaged in patient care activities. Information collected includes patient age, sex, race, ethnicity, and reason for visit; physician's diagnostic and therapeutic services ordered or provided; diagnosis and disposition decision, and drugs prescribed. The public use tapes are used to estimate the total number of ambulatory care visits with a principle or secondary diagnosis of ADM disorders, according to the ICD-9-CM listing of diagnoses shown in Appendix A.

There were 33.5 million ADM visits to office-based physicians in 1985 (Table 26). More than three-fifths (62.9 percent) of the visits are accounted for by women and less than two-fifths by men. Visits to psychiatrists comprise more than half (53.8 percent) of the total and distribution by sex of the 18 million visits to psychiatrists is similar to that for all visits -- 59.4 percent by women and 40.6 percent by men (NCHS, 1988a).

The age differences in the use of physician services by patients with ADM disorders are significant. The 25-44 age group accounts for 14.9 million visits or 44 percent of all visits and 56 percent of visits to psychiatrists. This age group comprises only 30.8 percent of the civilian noninstitutionalized population in the United States. ADM visits by persons aged 45-64 amount to 8.9 million or 26.6 percent of the total. This age group comprises 19.1 percent of the population. Table 27 distributes the 33.5 million ADM visits by diagnosis and age and sex. Almost all of the visits are for mental illness -- 32.8 million or 98 percent of the total. Only 504,000 visits are for alcohol abuse and 125 million for drug abuse. The costs of ADM visits to office-based physicians are based on the following charges: visits to psychiatrists -- \$90.40; visits to other physicians -- \$30.40. These charges, obtained from the American Medical Association, are based on two surveys: a special survey of psychiatrists in private practice (Gardocki, 1988) and the annual survey of physicians in medical practice (AMA, 1986). These charges are applied separately to the number of visits to psychiatrists and to other physicians.

In addition to the visits to physicians in their offices, there are also visits by physicians to hospitalized patients with ADM disorders. Costs for these visits are based on the number of days of care for discharges with a primary ADM diagnosis (Table 14). We conservatively estimate that half of these visits (11 million out of 22 million) result in a charge; the other half would be provided by interns and residents, who are covered in the costs per patient of short-stay hospitals. A charge per visit of \$45.20 is used (half the charge of psychiatrists in office-based practice) to estimate the costs of care in hospitals provided by private physicians.

Table 28 shows the total estimated costs of ADM visits to office-based physicians by sex, age, and diagnosis. Expenditures total \$2.3 billion, of which

TABLE 28

**COST OF ADM VISITS TO OFFICE-BASED PHYSICIANS*
BY AGE, SEX, AND DIAGNOSIS, 1985**

Age and Sex	(millions)			
	Total	Alcohol Abuse	Drug Abuse	Mental Illness
<i>Total</i>	\$2,344	\$141	\$51	\$2,151
<i>Under 15</i>	117	10	3	105
<i>15-44</i>	1,381	79	29	1,273
<i>45-64</i>	571	36	13	521
<i>65 & Over</i>	275	16	7	252
<i>Male</i>	970	100	31	839
<i>Under 15</i>	72	7	2	64
<i>15-44</i>	605	59	18	528
<i>45-64</i>	205	24	8	173
<i>65 & Over</i>	88	10	3	74
<i>Female</i>	1,373	41	20	1,312
<i>Under 15</i>	45	3	1	41
<i>15-44</i>	775	20	10	745
<i>45-64</i>	366	12	5	349
<i>65 & Over</i>	187	6	4	177

* Includes costs of about 11 million visits by physicians to patients with ADM disorders who are hospitalized.

SOURCE: National Ambulatory Care Survey, 1985; original tabulations from public use tapes.

\$2.2 billion (91.8 percent) is for care of the mentally ill, \$141 million (6.0 percent) for patients with a diagnosis of alcohol abuse, and the remaining \$51 million (2.2 percent) for drug abusers. Of the total \$33.5 billion, women account for \$21.1 billion (62.9 percent). The distribution by age of the total expenditures shows that the 15-44 age group accounts for the largest share -- 59 percent, followed by those aged 45-64 -- 24 percent. The elderly account for 12 percent of the total and the under-15 age group for 5 percent of the total (Figure 14).

Other Professional Services

A variety of health professionals provide services to people suffering from ADM disorders. Included are psychologists, social workers, nurses, physical and occupational therapists, pharmacists, technologists, and others. The salaries of health professionals employed in hospitals and nursing homes are included in the costs of care in these settings. Data are not available for estimating the number of professionals and costs associated with independent office-based practice, except for psychologists and social workers. An estimated total of \$3.7 billion is spent for services of psychologists and social workers who provide care in office-based practice to patients or clients with ADM disorders, distributed as follows: \$2.8 billion for psychologists and \$906 million for social workers.

Psychologists

The estimate of \$2.8 billion spent on the services of office-based, licensed, clinical psychologists is based on an estimated 55 million psychotherapy services, provided by 45,536 Ph.D.-level psychologists. Approximately two-thirds of these services are provided in office-based practices; the other third in organized settings. Each session is provided at an estimated cost of \$75 (G. Vandebus, American Psychological Association, personal communication, 1988).

Social Workers

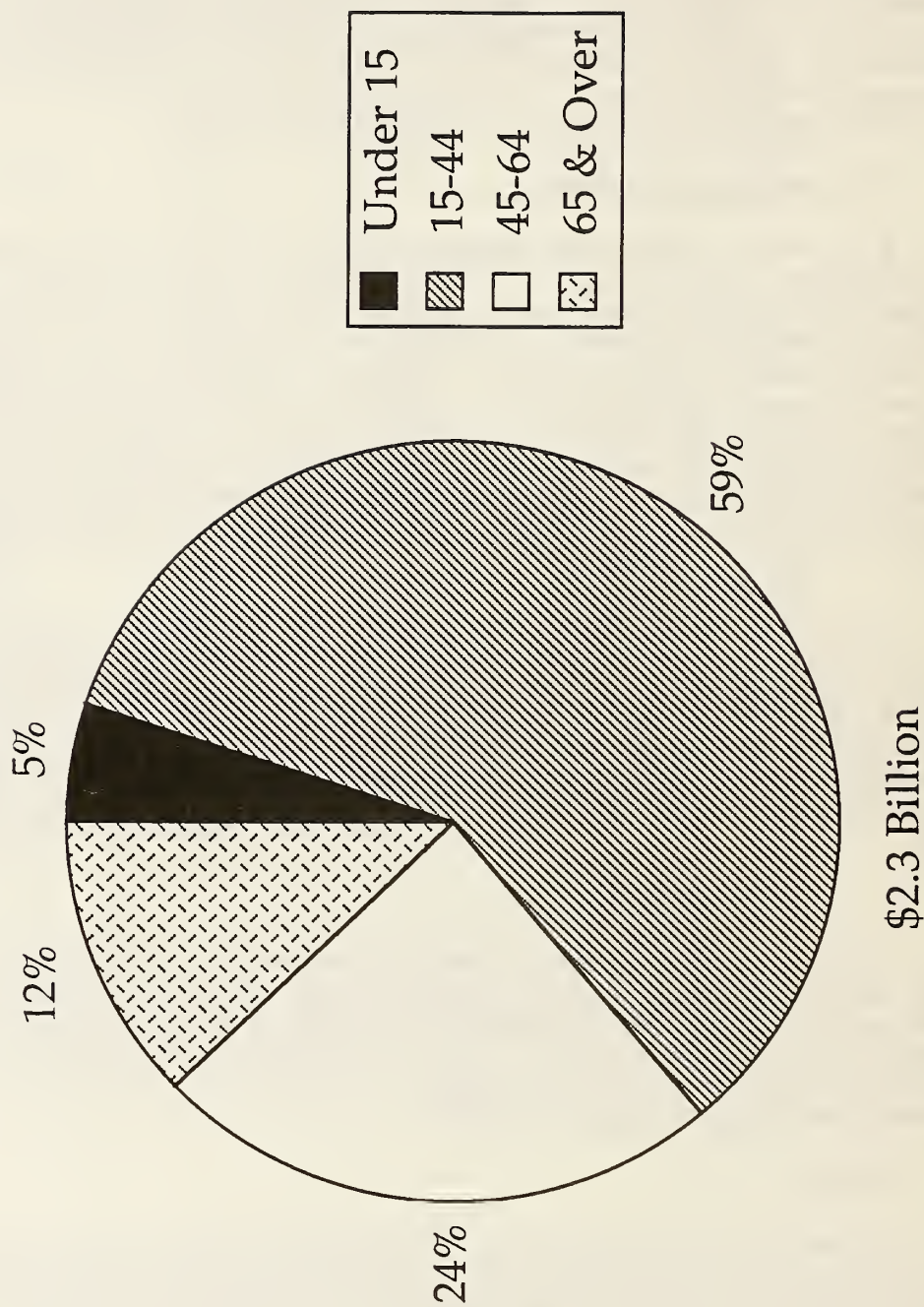
An estimate of \$906 million spent on the services of office-based clinical social workers is based on the results of a 1986 survey identifying a total of 30,000 social workers (MSW) in private clinical practice and other clinicians licensed by the American Council of Social Workers. Their average earnings are estimated at \$30,200 for 1985 (J. McTigue, American Council of Social Workers, personal communication, June 23, 1988).

Drugs

Expenditures for drugs, estimated at \$1,453 million, are included in the treatment and cost of mental illness, although some of these drugs are being used for treatment of alcohol and drug abuse. Included are the following types of medically prescribed psychotropic drugs: minor tranquilizers (60 percent), anti-depressants (16 percent), anti-psychotics (18 percent), and combination drugs (6 percent) (Table 29). The costs for these psychotropic prescription drugs are based on national estimates of 1985 outpatient prescription sales from the National Prescription Survey conducted by the Pharmaceutical Data Services, Scottsdale, Arizona. The estimates were prepared by Robert S. Beardsley, University of Maryland, School of Pharmacy, and David B. Larson, Division of Biometry and Applied Sciences, National Institute of Mental Health (NIMH).

Figure 14

Costs of ADM Visits to Office-Based Physicians by Age, 1985



The distribution of costs by age and sex is shown in Table 30. Of the \$1,453 million, \$943 million (65 percent) is for men, and the remaining \$510 million (35 percent) for women. The 15-44 age group accounts for the largest share of the total -- 39 percent, followed by the 45-64 age group -- 32 percent. The age and sex distribution is based on data from the 1985 National Ambulatory Care Survey (Hohmann et al., 1988).

Support Costs

Support costs related to the treatment of ADM disorders include federal expenditures for medical and health services research, training costs for physicians and nurses, program administration, and the net cost of private health insurance (Table 31). Federal research expenditures in 1985 by the Alcohol, Drug Abuse and Mental Health Administration (ADAMHA) and the Veterans Administration (VA) equal \$513 million, of which 66 percent (\$337 million) is attributable to ADM. Research related to mental illness comprises the greatest proportion of funds (\$218 million). The ADAMHA research expenditures are taken directly from the 1987 U.S. Budget. The VA research expenditures for ADM disorders are estimated as a percentage of the total VA research expenditures based on the portion of VA hospital costs represented by ADM.

ADM training costs in 1985 are estimated at almost \$559 million, and include private sector funds spent for undergraduate and graduate medical education and baccalaureate degree nursing programs. Also included is federal ADAMHA and VA spending derived in the same manner as the research expenditures (U.S. Executive Office of the President, 1986).

Expenditures for training of ADM physicians are estimated as a proportion of total public and private physician training costs (Jolly et al., 1986; Reynolds, 1986). The proportion is based on the number of ADM visits to office-based physicians as a percentage of total visits. ADM training costs for nurses are similarly based on total expenditures for nurses (Klemmer et al., 1987), and the proportion is based on the ADM costs of inpatient and ambulatory care in relation to total costs for these services.

ADM program administration costs and the net cost of private health insurance are estimated at 6.4 percent of the total treatment costs. The 6.4 percent is the proportion that all program administration expenditures and the net cost of private health insurance represent of total personal health expenditures in the national health expenditures accounts (U.S. HCFA, 1987). The allocation by ADM disorder is based on the proportion that each disorder represents of the total ADM treatment costs.

SOURCE OF PAYMENT

The substantial economic burden placed on American society by ADM disorders is borne by various types of payers -- federal, state, and local governments; private health insurance; and private individuals and philanthropy. Estimates of core direct medical treatment and support costs of ADM borne by these sources are presented. The indirect and other related costs are not distributed by source of payment. Because indirect costs represent the value of output due to reduced or lost productivity caused by illness, disability, and premature mortality, it is inappropriate to allocate these costs according to

Table 29

EXPENDITURES FOR PSYCHOTROPIC PRESCRIPTION DRUGS
BY TYPE OF DRUG, 1985

<u>Type of Drug</u>	<u>Amount (millions)</u>
Total	\$1,453.3
Minor Tranquilizers, including anti-anxiety agents and sedative hypnotic agents	867.3
Short & medium half-life benzodiazepines: anti-anxiety	346.9
Long half-life benzodiazepines: anti-anxiety	360.6
Mebroamate	8.1
Hydroxyzine	49.3
Long half-life benzodiazepines: sedative-hypnotic	75.5
Addictive sedative-hypnotics	26.2
Other not identified	.7
Anti-Depressants	239.8
Tricyclics	119.3
Bicyclics	56.5
New anti-depressants	58.0
MAO inhibitors	5.8
Other not identified	.2
Anti-Psychotics	262.6
Phenothiazines	147.2
Nonphenothiazines	101.2
Lithium	14.3
Combination Drugs	83.6

SOURCE: Pharmaceutical Data Services, 1985.

Table 30

EXPENDITURES FOR PSYCHOTROPIC PRESCRIPTION DRUGS
BY AGE AND SEX, 1985

<u>Age and Sex</u>	<u>Amount (millions)</u>	<u>Percent Distribution</u>
Total	\$1,453	100.0
Under 15	36	2.5
15-44	560	38.5
45-64	468	32.2
65 and Over	389	26.8
Male	943	64.9
Under 15	23	1.6
15-44	362	24.9
45-64	304	20.9
65 and Over	254	17.5
Female	510	35.1
Under 15	13	.9
15-44	198	13.6
45-64	164	11.3
65 and Over	135	9.3

SOURCE: Pharmaceutical Data Services, 1985 and Hohmann et al., 1988.

Table 31

SUPPORT COSTS FOR THE PROVISION OF ADM HEALTH CARE, 1985
(millions)

<u>Cost Category</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Total	\$3,935	\$495	\$201	\$3,239
Research	337	54	66	218
ADAMHA	308	49	64	195
VA	29	5	2	23
Training	559	37	15	506
Physicians	351	5	1	344
Nurses	100	20	8	71
ADAMHA	43	2	2	40
VA	65	10	4	51
Health Insurance Administration	3,039	404	120	2,515

SOURCES: U.S. Executive Office of the President, 1986, pp. K-28, 58, 411; U.S. Department of Health and Human Services, 1988, pp. 3-2, 3-3; Jolly et al., 1986, Table 2, p. 5571; Klemmer et al., 1987, pp. 176-184; U.S. Health Care Financing Administration, 1987, Table 4, p. 26; Reynolds, 1986, p. 787.

payer. Other related direct public and private expenditures for crime, motor vehicle crashes, and fire destruction associated with ADM disorders are difficult to distribute by payer because of lack of data. For example, motor vehicle crash costs and fires include legal fees, vehicle damage, and property destruction. Many of these costs are borne by private individuals and insurance companies. Although the public sector also pays for some of these costs, data are lacking to estimate the portion paid by federal or state and local governments. The analysis by source of payment, therefore, is limited to the core direct medical treatment and support costs. Data sources and methods used in developing the estimates are discussed after presentation of the findings.

Source of Payment by Treatment Setting

Table 5 in Chapter I shows the distribution of direct medical care costs by treatment setting and estimated source of payment for all three ADM disorders. Tables 32, 33, and 34 present the source of payment for alcohol abuse, drug abuse, and mental illness, respectively. For all three disorders, private sources account for 44 percent of the total \$51.4 billion; \$14.3 billion or 28 percent comes from federal funds, and about the same amount, \$14.6 billion, is paid by state and local funds.

There is considerable variation in source of payment by treatment. All of the ADM expenditures in federal provider treatment settings (Veterans Administration, Army, Navy, Air Force, and Indian Health Affairs) are estimated to be paid entirely from federal funds. Not surprisingly, more than four-fifths of the state and county psychiatric hospitals and other ADM institutions (residential treatment centers for emotionally disturbed children, freestanding ADM facilities, multi-service mental health organizations and correctional facilities) is supported by state and local funds. In contrast, three-fourths of care in private psychiatric hospitals comes from private sources.

Of expenditures for short-stay hospital care of ADM patients, 41 percent comes from federal sources, 15 percent from state and local funds, and the remaining 43 percent from private sources. About half (51 percent) of expenditures for nursing home care comes from public sources, with 27 percent from federal funds and 21 percent in state and local payments.

For outpatient care in private physicians' offices and for other professional services, private sources cover the bulk of expenditures – 91 percent of the total. Nine-tenths of expenditures for prescription drugs is paid by patients or family members.

Source of Payment by Disorder

There is some variation in source of payment for treatment of persons with the three disorders. Almost half (46 percent) of the expenditures for treatment of people with mental illness comes from private sources compared with about 35 percent of the care of persons suffering from alcohol abuse and drug abuse coming from this source (Figure 15). Federal funds finance a larger share of treatment costs of alcohol and drug abusers (about 38 percent) than of mentally ill persons (26 percent). State and local funds pay about 25 to 28 percent of the total treatment costs for each of the three disorders. The relatively higher private funding of the mentally ill is due to the high expenditures for care

Table 32

ALCOHOL ABUSE CORE DIRECT COSTS BY TREATMENT SETTING
AND SOURCE OF PAYMENT, 1985

<u>Treatment Setting</u>	<u>Amount (millions)</u>			
	<u>Total</u>	<u>Federal</u>	<u>State and Local</u>	<u>Private</u> ^[1]
Total	\$6,810	\$2,495	\$1,944	\$2,371
ADM Specialty and Federal Institutions	2,281	899	1,258	124
Federal Providers	664	664	-	-
State & County Psychiatric Hospitals	215	31	174	10
Private Psychiatric Hospitals	72	11	7	54
Other ADM Institutions	1,330	193	1,077	60
Other Treatment Costs	4,034	1,439	648	1,947
Short-Stay Hospitals	3,017	1,225	490	1,302
Office-Based Physicians	141	10	4	127
Other Professional Services	173	12	4	157
Nursing Homes	703	192	150	361
Drugs	-	-	-	-
Support Costs	495	157	38	300

[1] Includes private health insurance, direct payments by patients, and philanthropy.

Table 33

DRUG ABUSE CORE DIRECT COSTS BY TREATMENT SETTING
AND SOURCE OF PAYMENT, 1985

<u>Treatment Setting</u>	<u>Amount (millions)</u>			
	<u>Total</u>	<u>Federal</u>	<u>State and Local</u>	<u>Private</u> ^[1]
Total	\$2,082	\$806	\$517	\$759
ADM Specialty and Federal Institutions	570	233	298	39
Federal Providers	176	176	-	-
State & County Psychiatric Hospitals	91	13	74	4
Private Psychiatric Hospitals	30	4	3	23
Other ADM Institutions	273	40	221	12
Other Treatment Costs	1,311	509	204	598
Short-Stay Hospitals	1,242	504	202	536
Office-Based Physicians	52	4	1	47
Other Professional Services	17	1	1	15
Nursing Homes	-	-	-	-
Drugs	-	-	-	-
Support Costs	201	64	15	122

[1] Includes private health insurance, direct payments by patients, and philanthropy.

Table 34

MENTAL ILLNESS CORE DIRECT COSTS BY TREATMENT SETTING
AND SOURCE OF PAYMENT, 1985

<u>Treatment Setting</u>	<u>Amount (millions)</u>			
	<u>Total</u>	<u>Federal</u>	<u>State and Local</u>	<u>Private</u> [1]
Total	\$42,528	\$11,064	\$12,115	\$19,349
ADM Specialty and Federal Institutions	12,831	3,097	7,964	1,770
Federal Providers	1,433	1,433	-	-
State & County Psychiatric Hospitals	5,355	777	4,337	241
Private Psychiatric Hospitals	1,786	270	179	1,337
Other ADM Institutions	4,257	617	3,448	192
Other Treatment Costs	26,458	6,940	3,902	15,616
Short-Stay Hospitals	8,805	3,575	1,431	3,799
Office-Based Physicians	2,151	151	54	1,946
Other Professional Services	3,466	243	86	3,137
Nursing Homes	10,583	2,900	2,254	5,429
Drugs	1,453	71	77	1,305
Support Costs	3,239	1,027	249	1,963

[1] Includes private health insurance, direct payments by patients, and philanthropy.

in nursing homes and private psychiatric hospitals and for office-based and other professional services, all of which are financed mainly from private funds.

Data Sources and Methods

For the distribution by source of payment of direct treatment and support expenditures, a variety of data sources is used. The resulting figures represent a best estimate and not an exact accounting.

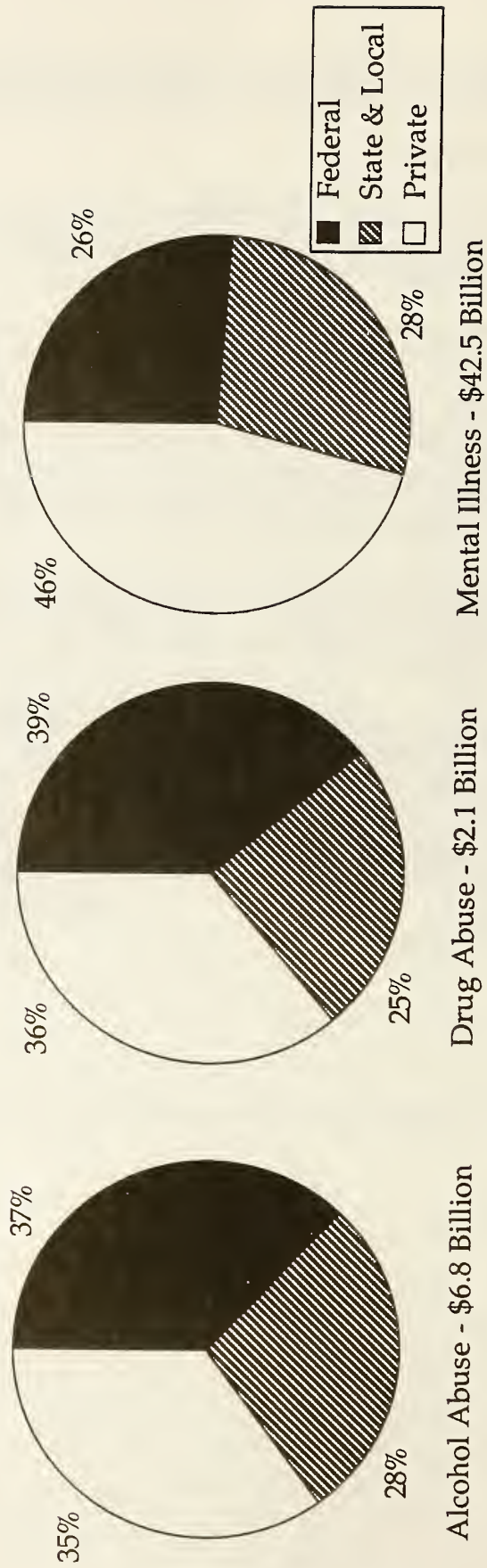
The principal data source for estimating source of payment for care in ADM specialty institutions is the Inventory of Mental Health Organizations conducted in June 1984 by NIMH and published in *Mental Health Statistical Note No. 180* (Redick et al., 1987). The distribution by source of payment for state and county psychiatric hospitals comes from a report on funding sources and expenditures for state mental health agencies conducted in 1985 by the National Association of State Mental Health Program Directors and published in *Mental Health, United States, 1987* (Manderscheid and Barrett, 1987, p. 170).

Unpublished data from the Inventory of Mental Health Organizations and General Hospital Mental Health Services conducted in 1986 by NIMH in cooperation with the American Hospital Association is the source of funds data for care in short-stay hospitals.

The 1985 National Ambulatory Care Survey, conducted by the National Center for Health Statistics (1988), is the source of data for the distribution by source of payment of care provided by office-based physicians and other professionals. Finally, the National Health Expenditures Accounts, produced annually by the Health Care Financing Administration, is the source of funds data for the following expenditure categories: nursing homes, drugs, and support costs.

Figure 15

Core Direct Costs by ADM Disorder and Source of Payment, 1985



CHAPTER IV

MORBIDITY COSTS

Morbidity costs are the value of goods and services lost by individuals unable to perform their usual activities because of ADM disorders, or to perform them at a level of full effectiveness. Technically, these costs are referred to as core indirect morbidity costs: indirect costs represent resources (available labor power) unused or underused (as opposed to resources expended as in the case of direct costs); morbidity costs refer to lowered output by individuals alive at the end of 1985 (rather than those who died during 1985); and core costs represent the lowered output of individuals with ADM disorders, not of their relatives, other caregivers, or others affected by the consequences of their disorders.

For 1985, these losses, shown in Table 35, are estimated at \$80.8 billion, of which 59 percent is attributable to mental illness, 34 percent to alcohol abuse, and 7 percent to drug abuse (Figure 16). On a gender basis, 72 percent is due to ADM disorders in men, and 28 percent to those in women (Figure 17). By age group, nearly all of the losses are sustained in the 25-64 age group, with 53 percent of the losses in the 25-44 age group and 44 percent in the 45-64 age group (Figure 18).

In Chapter IX, these estimates are compared with earlier estimates provided in Harwood et al. (1984), and in Appendices B and C of this report, the analytical basis of estimating income losses due to ADM disorders is discussed.

COMPUTATIONAL BASIS

The measurement of indirect costs is less straightforward than for direct costs. Direct costs measure expenditures or resources used as a result of ADM disorders, such as expenditures made for the hospital care of individuals with ADM disorders. The measurement of direct costs is relatively straightforward; for example, statistics are regularly and systematically collected on hospital utilization and ambulatory care by diagnosis.

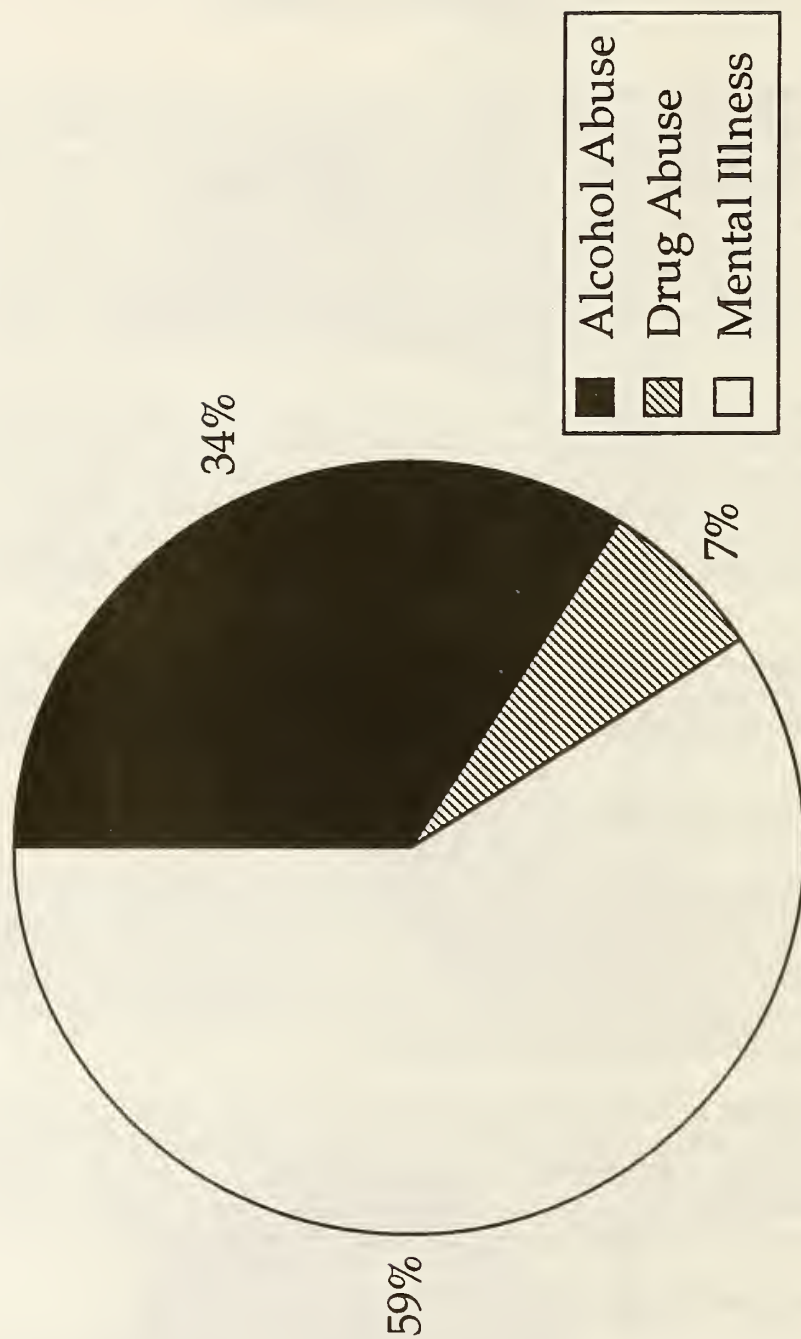
For indirect costs, however, statistics are not collected on the value of output not produced, which would have been produced had it not been for the prevalence of various disabilities. Instead, estimates are based on inferences that rely on a theoretical relationship between income and output. The nature of these inferences is described in detail in Appendices B and C.

Income Loss Computations

Aggregate income loss due to ADM disorders is expressed as an identity, the product of the number of individuals affected times the average income loss per individual due to ADM disorders. Each of these terms is further divided into two parts: 1) the number of individuals having ADM disorders is the size of the reference population times the relevant ADM prevalence rates; 2) the average income loss per individual with ADM is the percentage loss due to the disorder per individual times the average income level the individual would have earned had he or she not been affected by ADM disorders. Each of these terms is

Figure 16

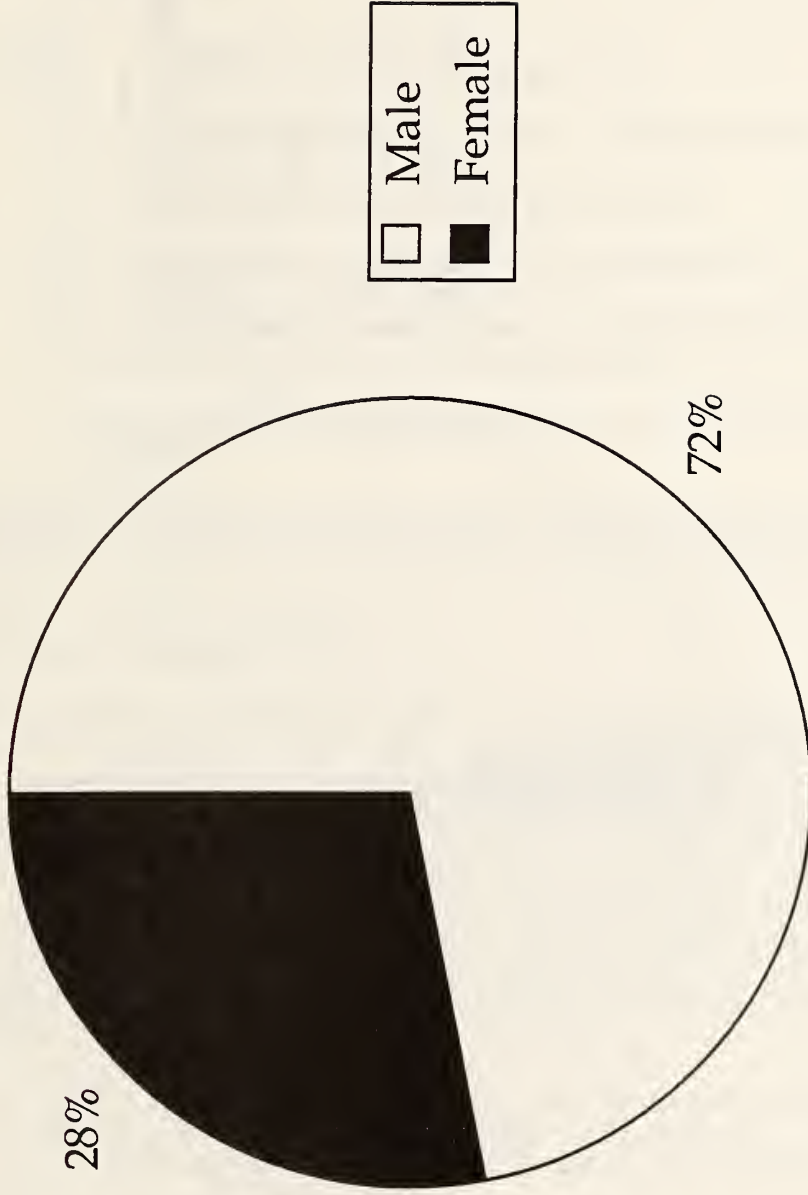
ADM Morbidity Costs, 1985



\$80.8 Billion

Figure 17

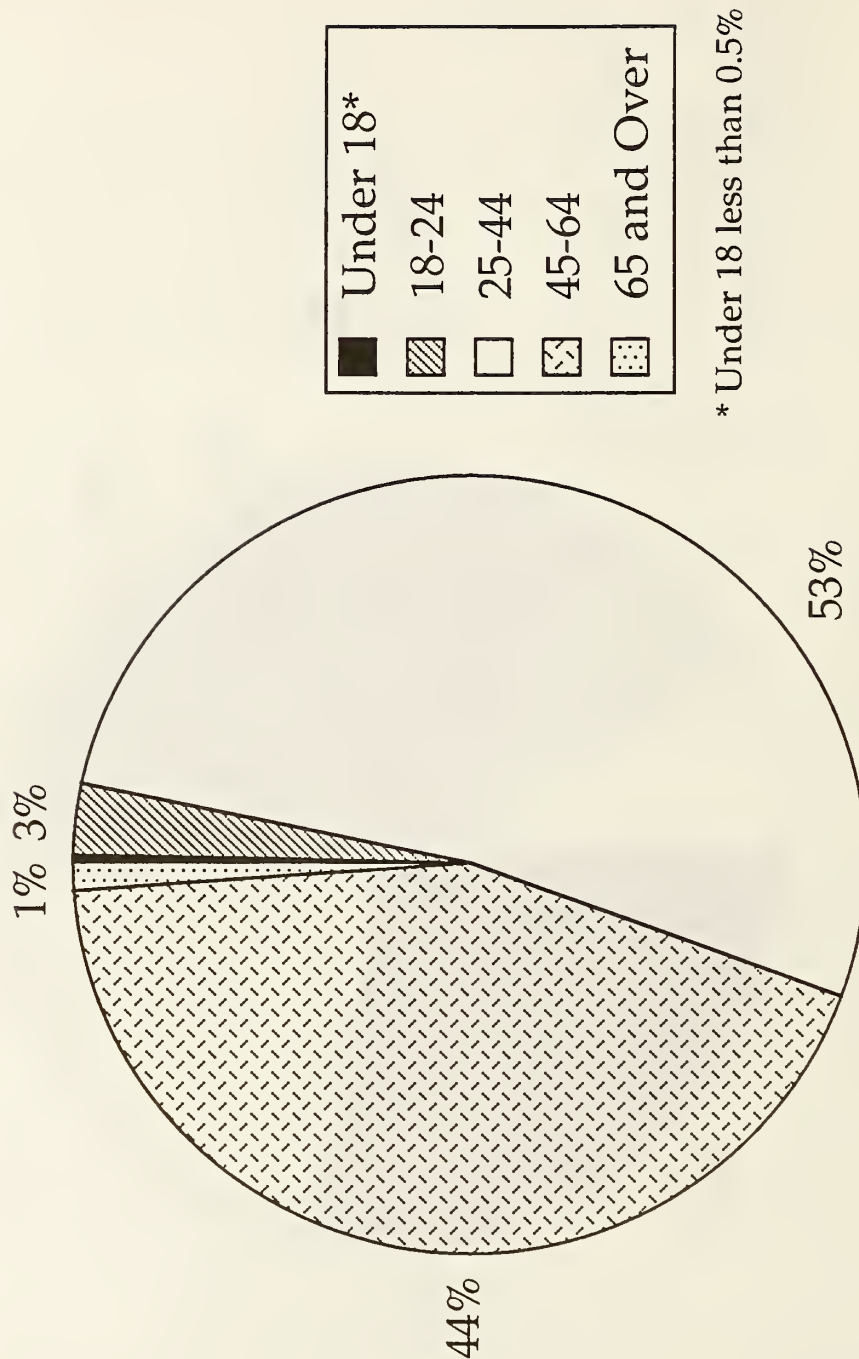
ADM Morbidity Costs by Sex, 1985



\$80.8 Billion

Figure 18

ADM Morbidity Costs by Age, 1985



\$80.8 Billion

disaggregated by age, sex, and disorder, except average income for persons without these disorders, which can only be disaggregated by age and sex.

The identity is given below:

$$\text{\$LOSS} = \sum \sum \sum (\text{POP}_{ij} * \text{PREV}_{ijk})(b_{ijk} * Y_{ij})$$

where $\text{\$LOSS}$ is the aggregate loss in income due to ADM disorders;

POP_{ij} is the size of the population by age and sex;

PREV_{ijk} is the prevalence rate, by age, sex, and disorder;

b_{ijk} is the percentage income loss per individual with ADM disorders, by age, sex, and disorder; and

Y_{ij} is the average income by age and sex for individuals without disorders.

Summing this four-term product over age, sex and ADM disorder provides an estimate of the aggregate loss of income due to ADM disorders among the entire population.

Computations for Subpopulations

The sampling frame of data bases used for the computations described above requires that aggregate income loss be based on a series of such computations. The sampling frame for the community-based surveys of ADM disorders that collect information on income or earnings is the civilian noninstitutionalized resident population. Included are the NIAAA-sponsored National Alcohol Survey (NAS), the NIDA-sponsored National Household Survey on Drug Abuse (NHSDA), and the public-use data sets available from the NIMH-sponsored Epidemiologic Catchment Area Program Community Surveys (ECA), although the latter is limited to the study population only in parts of four metropolitan areas and one largely rural area. Each of these surveys is discussed in Chapter IX and in Appendix B.

As a result of this defined sampling frame, the calculation of aggregate earnings loss must be developed from several calculations. Separate calculations, similar to the one described above, are therefore required for:

- Civilian noninstitutionalized resident population;
- Transient population, made up of homeless individuals and residents of transient hotels;
- Military population living on military bases and overseas; and
- Institutionalized population, residents of prisons, nursing homes, and psychiatric hospitals.

Table 35

ADM MORBIDITY COSTS* BY AGE AND SEX, 1985

<u>Age and Sex</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Total	\$80,762	\$27,388	\$5,979	\$47,395
Under 18	17	-	-	17
18 - 24	2,379	589	174	1,617
25 - 44	42,511	14,357	3,288	24,866
45 - 64	35,538	12,413	2,517	20,428
65 and over	497	30	-	467
Male	58,083	23,215	3,615	31,253
Under 18	12	-	-	12
18 - 24	1,581	483	119	979
25 - 44	30,900	12,114	1,996	16,790
45 - 64	25,273	10,598	1,500	13,175
65 and over	317	20	-	297
Female	22,679	4,173	2,364	16,141
Under 18	5	-	-	5
18 - 24	799	106	55	638
25 - 44	11,610	2,243	1,292	8,075
45 - 64	10,084	1,815	1,017	7,253
65 and over	180	10	-	170

* Includes costs for the noninstitutionalized and the institutionalized populations.

NOTE: Numbers may not add to totals due to rounding.

In the present study, losses incurred among the civilian noninstitutionalized resident population and among the institutionalized population are estimated. Chapter VII discusses losses among the homeless who, together with those living in transient hotels, make up the transient population. An estimate of income loss among the military population is not attempted.

ADM INCOME LOSSES IN THE CIVILIAN NONINSTITUTIONALIZED POPULATION

In describing the estimates of output loss among the civilian noninstitutionalized resident population, the identity described in the above equation is followed. The magnitude and sources of measures of the prevalent population is first described, followed by a description of the estimate of average income loss among the prevalent population. Because each of the four terms in the calculation varies considerably by age, sex, and disorder, the terms are calculated separately, where feasible.

Prevalent Population

The prevalent population is the number of people in the civilian noninstitutionalized resident population with the identified ADM disorders (Tables 36 - 38). Table 36 shows the size of the 1985 civilian noninstitutionalized resident population by age group and sex; Table 37 presents prevalence rates, the percentages of the above population with ADM disorders by age and sex; and Table 38 summarizes the estimated number of people with ADM disorders. Rates shown in Table 37 are based on the NIMH-sponsored ECA surveys of community areas in five locations in the country and weighted to the U.S. population by weights based on the 1980 Census. The surveys were conducted between 1980 and 1984 (see Appendix B), and therefore most accurately depict prevalence during the early 1980s.

The ADM disorders are defined and elaborated in Appendix B. The disaggregation of mental illness follows that of Regier and associates (1988). Table 38 multiplies the corresponding terms of the previous two tables and indicates the numbers of people in the civilian noninstitutionalized resident population with the indicated disorders. Because ECA surveys were conducted in the early 1980s, 1985 estimates of ADM prevalence shown in Table 38 are based on the assumption that prevalence rates remain the same in 1985 as when measured between 1980 and 1984.

Per Capita Income Losses

Per capita income losses are obtained by multiplying average incomes by the impairment rates due to each disorder by age and sex. Average income levels are obtained within each age and sex group by combining total civilian earnings, wage supplements, and the imputed value of household services by age and sex and dividing by the size of the civilian noninstitutionalized resident population. Table 39 presents total civilian earnings plus wage supplements (employer contributions for social insurance, private pensions, and welfare funds) per noninstitutionalized person; the table also presents the imputed value of housekeeping services. This imputation is made to account for the value of housework, a measure of the productivity of human labor not recorded in the

Table 36

CIVILIAN NONINSTITUTIONALIZED RESIDENT POPULATION
BY AGE AND SEX, 1985
(thousands)

<u>Age</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>
Total	143,933	69,677	74,256
18-24	27,413	13,360	14,053
25-34	40,898	20,032	20,866
35-54	53,472	25,889	27,583
55-64	22,150	10,396	11,754

SOURCES: U.S. Bureau of the Census, 1987a; National Center
for Health Statistics, 1986, Table 78.

Table 37

ADM PREVALENCE RATES, NONINSTITUTIONALIZED POPULATION,
BY AGE, SEX, AND DISORDER, EARLY 1980s

<u>Disorder and Age</u>	<u>Male</u>	<u>Female</u>	<u>Disorder and Age</u>	<u>Male</u>	<u>Female</u>
Substance Disorder			Mental Illness, cont'd.		
Alcohol Abuse			Anxiety Disorders		
18 - 24	27.3%	10.0%	18 - 24	16.7%	21.4%
25 - 34	22.0	4.6	25 - 34	12.5	18.9
35 - 54	28.9	5.1	35 - 54	16.2	22.8
55 - 64	18.6	2.3	55 - 64	10.9	16.6
Drug Abuse			Somatization		
18 - 24	8.6	6.7	18 - 24	-	0.1
25 - 34	5.6	3.4	25 - 34	0.1	0.2
35 - 54	2.7	1.9	35 - 54	0.1	0.3
55 - 64	-	0.4	55 - 64	-	0.9
Mental Illness			Anti-Social Personality		
Schizophrenic Disorders			18 - 24	12.4	4.7
18 - 24	2.5	3.3	25 - 34	11.9	2.6
25 - 34	1.4	2.2	35 - 54	10.3	1.9
35 - 54	1.4	2.0	55 - 64	3.1	0.6
55 - 64	0.5	0.6	Cognitive Impairment		
Affective Disorders			18 - 24	0.3	0.3
18 - 24	16.7	13.5	25 - 34	0.0*	0.2
25 - 34	18.8	16.6	35 - 54	0.4	0.3
35 - 54	29.0	21.2	55 - 64	1.2	0.6
55 - 64	17.4	9.6			

* Less than 0.05 percent.

SOURCE: Based on Epidemiologic Catchment Area Surveys.

Table 38

ADM PREVALENCE, NONINSTITUTIONALIZED POPULATION,
BY AGE, SEX, AND DISORDER, 1985
(thousands)

<u>Disorder and Age</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>
Substance Disorder			
Alcohol Abuse	21,504	17,458	4,046
18-24	5,057	3,653	1,404
25-34	5,352	4,403	949
35-54	8,892	7,474	1,418
55-64	2,204	1,928	275
Drug Abuse	5,191	2,964	2,227
18-24	2,095	1,148	947
25-34	1,815	1,112	703
35-54	1,237	704	532
55-64	45	-	45
Mental Illness			
Schizophrenic Disorders	2,577	1,012	1,564
18-24	803	339	464
25-34	732	270	461
35-54	920	355	565
55-64	122	48	74
Affective Disorders	27,655	15,307	12,348
18-24	4,127	2,232	1,894
25-34	7,226	3,760	3,466
35-54	13,369	7,508	5,861
55-64	2,933	1,807	1,126
Anxiety Disorders	25,264	10,074	15,191
18-24	5,236	2,228	3,007
25-34	6,452	2,506	3,946
35-54	10,491	4,202	6,289
55-64	3,086	1,137	1,949
Somatization	281	29	252
18-24	14	-	14
25-34	54	16	38
35-54	107	13	94
55-64	107	-	107
Anti-Social Personality	8,839	7,039	1,800
18-24	2,322	1,662	660
25-34	2,931	2,382	549
35-54	3,201	2,677	524
55-64	385	318	67
Cognitive Impairment	489	272	217
18-24	77	35	42
25-34	39	8	31
35-54	178	104	74
55-64	195	126	69

SOURCE: Product of Tables 36 and 37.

Table 39

PER CAPITA INCOME, NONINSTITUTIONALIZED POPULATION,
BY AGE AND SEX, 1985

<u>Age and Sex</u>	<u>Total</u>	<u>Earned[1] Income</u>	<u>Imputed Value[2] Housekeeping Services</u>
Male	\$26,313	\$23,811	\$2,502
18-24	9,092	7,482	1,610
25-34	26,621	23,925	2,696
35-54	35,637	32,746	2,891
55-64	24,631	22,322	2,308
Female	14,198	9,566	5,353
18-24	8,938	4,762	4,176
25-34	17,605	11,428	6,178
35-54	17,949	11,837	6,112
55-64	10,189	6,675	3,514

SOURCES: [1] U.S. Bureau of the Census, 1987b, Table 36.

[2] Miller update of Peskin (1984) estimates (see Chapter V, Mortality Costs).

Table 40

ADM INCOME LOSSES BY AGE, SEX, AND DISORDER, 1985

<u>Disorder and Age</u>	<u>Percent Loss of Income[1]</u>		<u>Average Loss per[2] Person with ADM</u>	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
Substance Disorder				
Alcohol Abuse				
18-24	1.4%	0.8%	\$131	\$75
25-34	3.0	2.8	807	484
35-54	5.5	11.9	1,958	2,141
55-64	9.3	18.7	2,295	1,900
Drug Abuse				
18-24	1.1	0.6	99	56
25-34	2.6	2.3	685	412
35-54	8.3	18.0	2,954	3,230
55-64	-	-	-	-
Mental Illness				
Schizophrenic Disorders				
18-24	7.1	3.3	650	298
25-34	8.3	6.6	2,211	1,168
35-54	30.0	9.4	10,571	1,691
55-64	77.2	14.8	19,024	1,508
Anxiety Disorders				
18-24	1.2	1.0	109	93
25-34	2.5	2.3	661	412
35-54	6.2	5.8	2,225	1,044
55-64	9.3	12.2	2,289	1,240
Anti-Social Personality				
18-24	2.5	0.0*	228	2
25-34	3.8	0.0*	1,008	7
35-54	5.7	0.1	2,015	13
55-64	8.4	0.1	2,064	11
Cognitive Impairment and Somatization				
18-24	10.3	37.2	939	3,329
25-34	10.3	37.2	2,749	6,558
35-54	10.3	37.2	3,680	6,686
55-64	10.3	37.2	2,544	3,795

* Less than 0.05 percent

SOURCES: [1] Appendix B.

[2] Product of Table 39 and Percent Lost of Income.

market value of incomes earned (See "Valuing Household Service" in Chapter VI for a discussion of sources and methods of this imputation). The total value of per capita income is thus calculated (Table 39).

Table 40 presents the ADM impairment rates by age, sex, and disorder. The estimation of these rates is the primary subject of Appendix B; the timing model used in the estimation of impairment rates is presented in Appendix C. In summary, regression analysis is employed to estimate impairment rates based on a model that measures the lifetime effect on current income of individuals with these disorders, taking into account the timing and duration of ADM disorders. Timing and duration are based on measures of time of onset and time of last symptom relative to the time of interview. The impairment rates are the adjusted cross-sectional regression coefficients obtained when the natural logarithm of personal income is regressed on lifetime measures of individual alcohol, drug, or mental disorder prevalence and other control variables. Multiplying the impairment rates by average incomes, then, yields measures of the annual income loss per individual with the disorder by age, sex, and disorder (Table 40).

Total ADM Morbidity Losses

The aggregate ADM morbidity losses shown in Table 41 are obtained by multiplying the corresponding terms of Tables 38 and 40. Within this population, ADM disorders account for aggregate losses of \$77.2 billion. Mental illness accounts for 57 percent of the total, whereas alcohol abuse accounts for 35 percent and drug abuse for 8 percent. Nearly three quarters of the aggregate losses are attributable to men and more than one quarter is attributable to women. Over 60 percent of the losses are incurred by the 35-54 age group. Table 42 translates the results in Table 41 into the age groupings used throughout the remainder of this study.

ADM INCOME LOSSES IN THE INSTITUTIONALIZED POPULATION

In addition to the morbidity losses due to ADM illnesses for the noninstitutionalized population, losses for the institutionalized populations are also estimated. Persons institutionalized because of ADM illness include those in mental hospitals and in nursing homes.

The number of residents by age, sex, and mental disorder in state and county mental hospitals is provided by the National Institute of Mental Health (Manderscheid, 1988). The number of residents in nursing homes by age, sex, and diagnosis are from the 1985 National Nursing Home Survey (NCHS, 1989). The number of institutionalized persons classified by ADM diagnoses within each age and sex group is adjusted downward by labor force participation rates. These figures are then multiplied by the estimated mean earnings, adjusted for wage supplements, for each age and sex group to obtain morbidity costs for the ADM institutionalized population.

The results are shown in Tables 43 - 46. A total of 755,840 persons with ADM diagnoses were in mental hospitals and in nursing homes in 1985. Productivity losses are estimated at \$3.5 billion. Mental hospital residents account for 15 percent of the institutionalized population, and due to the younger age distribution in mental institutions, 55 percent of the costs. Persons

Table 41

ADM MORBIDITY LOSSES, NONINSTITUTIONALIZED POPULATION,
BY DISORDER AND AGE, 1985
(millions)

<u>Disorder and Age</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>
Total	\$77,238	\$55,677	\$21,561
18-24	2,232	1,466	767
25-34	12,405	9,035	3,370
35-54	49,040	35,632	13,407
55-64	13,561	9,544	4,017
Alcohol Abuse	27,208	23,086	4,122
18-24	583	478	105
25-34	4,011	3,552	460
35-54	17,666	14,631	3,035
55-64	4,948	4,426	523
Drug Abuse	5,943	3,584	2,359
18-24	167	113	54
25-34	1,052	762	289
35-54	3,800	2,080	1,720
55-64	925	629	296
Mental Illness	44,087	29,007	15,079
18-24	1,483	875	608
25-34	7,342	4,721	2,621
35-54	27,574	18,921	8,653
55-64	7,687	4,490	3,198

SOURCE: Product of Tables 38 and 40, includes imputation for income losses due to drugs in the 55-64 year age group, both sexes.

NOTE: Numbers may not add to totals due to rounding.

Table 42

ADM MORBIDITY LOSSES, NONINSTITUTIONALIZED POPULATION,
REDISTRIBUTED AGE GROUPS, BY DISORDER AND AGE, 1985
(millions)

<u>Disorder and Age</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>
Total	\$77,238	\$55,677	\$21,561
18-24	2,232	1,466	767
25-44	40,943	29,776	11,166
45-64	34,063	24,435	9,627
Alcohol Abuse	27,208	23,086	4,122
18-24	583	478	105
25-44	14,293	12,068	2,225
45-64	12,333	10,540	1,793
Drug Abuse	5,943	3,584	2,359
18-24	167	113	54
25-44	3,262	1,973	1,289
45-64	2,514	1,498	1,016
Mental Illness	44,087	29,007	15,079
18-24	1,483	875	608
25-44	23,388	15,735	7,652
45-64	19,216	12,397	6,819

SOURCE: Table 41.

Table 43

NUMBER AND DISTRIBUTION OF ADM INSTITUTIONALIZED RESIDENTS AND
MORBIDITY COSTS BY TYPE OF INSTITUTION, DISORDER, AGE, AND SEX, 1985

<u>Characteristic</u>	<u>Residents</u>		<u>Morbidity Costs</u>	
	<u>Number</u>	<u>Percent Distribution</u>	<u>Amount (millions)</u>	<u>Percent Distribution</u>
Total	755,840	100.0	\$3,524	100.0
Type of Institution				
Mental Hospitals	109,940	14.5	1,931	54.8
Nursing Homes	645,900	85.5	1,593	45.2
Disorder				
Alcohol Abuse	44,325	5.9	180	5.1
Drug Abuse	1,775	0.2	36	1.0
Mental Illness	709,740	93.9	3,308	93.9
Age				
Under 18	6,087	0.8	17	0.5
18-24	11,094	1.5	147	4.2
25-44	64,418	8.5	1,568	44.5
56-64	80,195	10.6	1,295	36.7
65 and Over	594,046	78.6	497	14.1
Sex				
Male	248,894	32.9	2,406	68.3
Female	506,946	67.1	1,118	31.7

SOURCE: Based on the number of residents in nursing homes and in state and county mental hospitals adjusted for labor force participation.

under age 65 comprise about 4 of 5 mental hospital residents compared with only 1 of 10 nursing home residents. In addition, three-fifths of mental hospital residents are men and their productivity losses are based on higher earnings than for women. Thus, the combination of more relatively younger males and their higher earning potential accounts for the significantly higher morbidity costs for persons in mental institutions than for those in nursing homes. Patients with mental illness in both types of institutions account for 94 percent of the residents and of morbidity costs.

The distribution of the total ADM institutionalized residents and costs by sex shows that women account for 67 percent of the residents and only 32 percent of the morbidity costs, reflecting the overwhelmingly large proportion of elderly women among nursing home residents and their low incomes. The distribution by age shows that 8.5 percent of the institutionalized population aged 25-44 account for 45 percent of the productivity losses. By contrast, elderly residents in both types of institutions account for 79 percent of the residents and only 14 percent of the morbidity costs.

SOURCES OF OVER- AND UNDERESTIMATES OF INDIRECT COSTS

Data limitations inevitably introduce qualitatively predictable inaccuracies in the estimates for which they are used. A number of sources of difficulty unavoidably remain in the estimates. The data limitations are primarily of two types: an absence of relevant data or suitable data on which to base the estimates.

For the total resident civilian population, the available data also present enormous challenges. While the measurement of average income levels, prevalence rates, and population counts is relatively unambiguous, the estimation of impairment rates is a major econometric research undertaking and is described in Appendices B and C. Estimation would be complex even with an ideal data set, but is especially so with the available data bases. Several sources of over- and underestimates of the results reported above are described below.

Overestimation

There is one apparent source of possible overestimation of morbidity losses. In the regression analysis of the natural logarithm of personal income on ADM prevalence measures and control variables, the entire income loss *associated* with ADM diagnosis is *attributed* to the ADM diagnosis. ADM disorders may be only one component in a constellation of personal, familial, and social factors leading to poor economic outcomes. If those factors or all of their causal antecedents are not explicitly included as control variables in the regression equations yielding impairment rates, the results will overstate the effect of ADM disorders on income. For example, if the prevalence of alcohol and drug abuse is partly determined by familial circumstances such as parental education, occupation, and income, and the equation that estimates the relationship between income and drug and alcohol abuse does not control for those parental characteristics, the empirical relationship found will overstate the degree to which alcohol and drug abuse *cause* income loss.

Table 44

NUMBER OF ADM INSTITUTIONALIZED RESIDENTS AND MORBIDITY COSTS
BY AGE, SEX, AND DISORDER, 1985

<u>Age and Sex</u>	<u>Number of Residents</u>				<u>Morbidity Costs (millions)</u>			
	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Total	755,840	44,325	1,775	709,740	\$3,524	\$180	\$36	\$3,308
Under 18	6,087	38	152	5,897	17	*	*	17
18-24	11,094	441	517	10,136	147	6	7	134
25-44	64,418	2,677	931	60,810	1,568	64	26	1,478
45-64	80,195	4,722	118	75,355	1,295	80	3	1,212
65 and Over	594,046	36,447	57	557,542	497	30	*	467
Male	248,894	14,669	1,380	232,845	2,406	129	31	2,246
Under 18	4,030	26	103	3,901	12	*	*	12
18-24	7,994	365	420	7,209	115	5	6	104
25-44	36,737	1,537	747	34,453	1,124	46	23	1,055
45-64	28,233	1,959	80	26,194	838	58	2	778
65 and Over	171,900	10,782	30	161,088	317	20	*	297
Female	506,946	29,656	395	476,895	1,118	51	5	1,062
Under 18	2,057	12	49	1,996	5	*	*	5
18-24	3,100	76	97	2,927	32	1	1	30
25-44	27,681	1,140	184	26,357	444	18	3	423
45-64	51,962	2,763	38	49,161	457	22	1	434
65 and Over	422,146	25,665	27	396,454	180	10	*	170

* Less than \$500,000.

SOURCE: Based on the number of residents in nursing homes and in state and county mental hospitals, adjusted for labor force participation.

Table 45

NUMBER OF ADM MENTAL HOSPITAL RESIDENTS AND MORBIDITY COSTS
BY AGE, SEX, AND DISORDER, 1985

Age and Sex	Number of Residents				Morbidity Costs (millions)			
	Total	Alcohol Abuse	Drug Abuse	Mental Illness	Total	Alcohol Abuse	Drug Abuse	Mental Illness
Total	109,940	4,125	1,775	104,040	\$1,931	\$82	\$36	\$1,813
Under 18	6,087	38	152	5,897	17	*	*	17
18-24	11,094	441	517	10,136	147	6	7	134
25-44	45,013	1,470	931	42,612	1,177	40	26	1,111
45-64	24,676	1,266	118	23,292	531	33	3	495
65 and Over	23,070	910	57	22,103	59	3	*	56
Male	65,394	3,248	1,380	60,766	1,512	74	31	1,407
Under 18	4,030	26	103	3,901	12	*	*	12
18-24	7,994	365	420	7,209	115	5	6	104
25-44	31,224	1,194	747	29,283	956	36	23	897
45-64	12,460	977	80	11,403	385	30	2	353
65 and Over	9,686	686	30	8,970	44	3	*	41
Female	44,546	877	395	43,274	419	8	5	406
Under 18	2,057	12	49	1,996	5	*	*	5
18-24	3,100	76	97	2,927	32	1	1	30
25-44	13,789	276	184	13,329	221	4	3	214
45-64	12,216	289	38	11,889	146	3	1	142
65 and Over	13,384	224	27	13,133	15	*	*	15

* Less than \$500,000.

SOURCE: Based on the number of resident patients in state and county mental hospitals, unpublished NIMH data.

Table 46

NUMBER OF ADM NURSING HOME RESIDENTS AND MORBIDITY COSTS
BY AGE, SEX, AND DISORDER, 1985

<u>Age and Sex</u>	<u>Number of Residents</u>			<u>Morbidity Costs (millions)</u>		
	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Mental Illness</u>	<u>Total</u>	<u>Alcohol Abuse</u>	<u>Mental Illness</u>
Total	645,900	40,200	605,700	\$1,593	\$98	\$1,495
25-44	19,405	1,207	18,198	391	24	367
45-64	55,519	3,456	52,063	764	47	717
65 and Over	570,976	35,537	535,439	438	27	411
Male	183,500	11,421	172,079	894	55	839
25-44	5,513	343	5,170	168	10	158
45-64	15,573	982	14,791	453	28	425
65 and Over	162,214	10,096	152,118	273	17	256
Female	462,400	28,779	433,621	699	43	656
25-44	13,892	864	13,028	223	14	209
45-64	39,746	2,474	37,272	311	19	292
65 and Over	408,762	25,441	383,321	165	10	155

SOURCE: Based on the number of nursing home residents from the 1985 National Nursing Home Survey.

In principle, this bias results from ignoring simultaneous relationships in the underlying behavior under investigation. Although there are techniques for correcting for this bias, the degree of complexity already built into the estimates prohibits the additional correction for "least-squares bias."

Underestimation

Transient Population

No estimates are attempted for ADM-related income losses among the transient population. The prevalence of all three ADM disorders is quite high among this group, but, as in the previous discussion, the direction of causation is difficult to know. More limiting, however, is the lack of any data source on the transient population with which to make the same inferences that were made on the civilian noninstitutionalized resident population. Chapter VII discusses the ADM-associated losses among the homeless population.

Military Population

Similarly, the military population is not part of the sampling frame of the ECA Survey, nor of the civilian noninstitutionalized resident population base of the calculations reported above. Because the military operates as a non-market economy, the inferred relationship between individual income and productivity invoked in the analysis of the civilian noninstitutionalized resident population would probably not be plausible for the military, even if a suitable database were available.

Civilian Noninstitutionalized Resident Population

A number of data and technical limitations remain in the estimates of income loss for this largest portion of the population. All the limitations are likely to result in underestimates, to some degree, of income losses due to ADM disorders as described below.

- 1) Estimates of income loss among this population are calculated only for the population between the ages of 18 and 64. Some portions of the population under 18 and over 64 do participate in the labor market. To the degree that portions of those groups suffer earnings losses due to ADM disorders, there is a degree of understatement of indirect costs. Because the labor force participation rates of these two age groups is very low, however, the resulting underestimation is believed to be quite low.
- 2) Average per capita income is not adjusted for disorders. Aggregate U.S. income per capita already has built into it output not produced because of ADM disorders. Technically, this measure (shown in Table 39) should be the per capita income of the population without ADM. Were this adjustment made, estimated income losses would be greater by the degree to which ADM disorders lower overall income among the noninstitutionalized population. Technical limitations prevent the application of these adjustments.

3) Percent income loss coefficients are based on regressions of personal income rather than of personal earnings, which is the correct theoretical variable. While existing data sets do not permit a direct estimate of the direction of the effect of this substitution, it is reasonable to assume that personal income, including transfer payments, would be less sensitive to ADM disorders than would personal earnings, which do not include transfer payments. It is difficult to speculate on the magnitude of this effect.

4) Ignoring age-sex-disorder cells with positive estimated income loss coefficients probably contributes to an understatement of aggregate income loss. In the regression analysis yielding income-loss coefficients (Table B-6), affective disorders are found to have impairment rates of +1 to +5 percent for both men and women (See Appendix B). In other words, affective disorders are associated with higher, rather than lower, incomes after controlling for other factors. The positive coefficients on affective disorders probably results from one or more simultaneous relationships in the income-disorder equation; i.e., disorders with positive income loss coefficients are either most prevalent among higher income groups or the apparent positive relationship is an income-related artifact of the manner in which the questions were framed, posed, or answered. In the results reported in Appendix B, the recorded prevalence of affective disorders is substantially higher among the working than the non-working population. This same degree of differential prevalence is not found for other disorders.

The positive finding does not suggest that having an affective disorder increases one's income; only that the likely negative effect on income is outweighed in the regression by the simultaneous income-prevalence effect for which no adjustment is made. The fact that the prevalence of affective disorders (major depression, dysthymia, and mania) is quite high (Table 37), may result in a considerable understatement, although it is quite possible that the underlying structural coefficients of income loss due to affective disorders is relatively small.

5) Diagnoses of many prevalent psychiatric disorders that may have significant income compromising effects were not attempted in the ECA survey (See Appendix B). As a result, the overall prevalence of mental disorders is likely understated as are their effects on income.

Choice of Prevalence Measure

In general, three types of prevalence measure can be employed in a study such as this. Prevalence can be measured by the number of individuals who satisfy clinical criteria for a diagnosis, such as those rendered by the DSM-III or DSM-III-R classification system for psychiatric diagnoses, including drug and alcohol disorders. Alternatively, prevalence can be measured by the number of individuals reporting or exhibiting a minimal list of problem behaviors consequent to the disorder in question. Finally, for substance abuse, prevalence can be measured by the number of individuals ingesting a minimum quantity of the substance with at least some measure of regularity, over some portion of

their lifetime. The analysis of morbidity costs reported by Harwood and associates (1984) uses a quantity-frequency measure of prevalence for costs related to drugs and a problem-based measure in its analysis of alcohol-related costs. The present study, in contrast, uses diagnostic measures.

A question arises as to whether the choice of type of prevalence measure influences the resulting morbidity cost estimates. Although it is tempting to believe that more restrictive prevalence measures lead to lower estimates of morbidity cost, such an assumption is probably not correct.

From the equation given earlier in this chapter, the estimate for morbidity costs among the civilian noninstitutionalized resident population is the product of four terms: prevalence, population, impairment, and average income. The choice of type of prevalence measure and, in particular, its degree of restrictiveness affect not only the prevalence rate, but also, and most likely in the opposite direction, the impairment measure. The size of the population and the average level of income of the population without ADM disorders are unaffected by the choice of prevalence measure.

The more restrictive the selection criteria, regardless of the type of prevalence measure, the more severe the disorders of the average prevalent individual will be, and the fewer affected individuals there will be in a given population. But analysis of the incomes of individuals with more severe disorders in comparison with individuals without ADM disorders yield higher estimates of per capita income loss per individual with ADM disorders. Whether the relationship between lower prevalence and higher income loss is perfectly hyperbolic (their product is a constant) is an empirical question neither confirmed nor rejected by the results of this study. On a priori grounds, however, more restrictive prevalence measures are no more likely to reduce than to increase the value of estimated morbidity costs. In either case, the effect is likely to be extremely small.

CONCLUSION

There remain several limitations to accurate estimation of income losses due to ADM disorders. Evident sources of over- or underestimation are described above. Most result in underestimates with effects felt on all three categories of ADM disorders. The only exceptions are that the non-use of an income loss measure for affective disorders in the present analysis and the restriction of the ECA survey to the mental illnesses listed above understate the losses due to mental illness, but not to alcohol or drug abuse.

Of the nine possible sources of distortion mentioned, only two would be likely to contribute significantly to the estimates, if evaluated. If per capita income were adjusted to reflect the incomes of those without ADM disorders only, it is possible that total estimated losses might be 10 percent higher than reported. This increment would be distributed proportionately over the three ADM categories. If personality disorders and other psychiatric diagnoses not included in the ECA survey were used, it is possible that the income losses attributable to mental illness would be 10 percent higher.

CHAPTER V

MORTALITY COSTS

Mortality costs are the current monetary value of future output lost due to premature death. If individuals had not died prematurely, they would have continued to be productive for a number of years. The estimated cost or value to society of all deaths is the product of the number of deaths and the discounted value of an individual's future earnings with sex and age taken into account. This method of derivation takes into consideration life expectancy for different age and sex groups, changing patterns of earnings at successive ages, varying labor force participation rates, imputed value for housekeeping services, and the appropriate discount rates to convert a stream of costs or benefits into its present worth.

The basis for estimating the number of deaths due to alcohol and drug abuse and mental illness (ADM); the economic assumptions and variables used in estimating the lifetime earnings; and our findings are described below. The formula for calculating the lifetime earnings is presented in Appendix E.

ADM DEATHS

Costs of mortality due to alcohol abuse, drug abuse, and mental illness are the product of deaths due to these causes and the present value of future earnings lost. Included are all of the deaths for which the underlying cause is coded as alcohol abuse, drug abuse, or mental illness, as shown in Tables 47 - 49. The number of deaths by age and sex are from the 1985 Summary Vital Statistics public use data tapes prepared by the National Center for Health Statistics. For alcohol abuse, the underlying cause could lead to overlooking substantial numbers of cases in which alcohol might be implicated as a contributing cause of death. For example, alcohol is a major risk factor for many injury fatalities. About half the deaths due to motor vehicle traffic accidents, two-fifths of deaths from falls and fires and burns, and three-tenths of drownings are estimated to involve alcohol (Rice and MacKenzie, 1989, p. 57).

Estimates of the proportion of deaths for selected causes attributable to alcohol were obtained from several sources. The National Institute on Alcohol Abuse and Alcoholism (NIAAA) staff provided references and guidance for the percentages of deaths attributable to alcohol shown in Table 47. The primary references summarizing the scientific evidence for these percentages are Parker et al. (1985), Ravenholt (1984), and Roizen (1985). The number of deaths for each cause by sex and five-year age groups are from the National Center for Health Statistics Vital Statistics Summary public use tapes.

Table 47 shows the number of deaths attributable to alcohol. Of the 94,768 deaths attributed to alcohol for 1985, 17,611, or 18.6 percent, are those in which alcohol is the primary cause. The remaining 77,157 are alcohol-related deaths. Included are varying proportions of deaths due to malignant neoplasms, injuries and accidents, violence, and other causes. Except for motor vehicle fatalities, the percentages attributable to alcohol shown in Table 47 were applied uniformly across all age groups. The distribution by age of motor vehicle fatalities is from

Table 47

NUMBER OF ALCOHOL AND ALCOHOL-RELATED DEATHS BY CAUSE OF DEATH, 1985

Cause of Death	ICD-9-CM Code	Total Number	Attributable to Alcohol	
			Number	Percent
Total			94,768*	
Alcohol - Main Cause		17,611	17,611	100
Alcoholic psychoses	291	368	368	100
Alcohol dependence syndrome	303	4,188	4,188	100
Alcohol abuse	305.0	750	750	100
Alcoholic polyneuropathy	357.5	2	2	100
Alcoholic cardiomyopathy	425.5	767	767	100
Alcoholic gastritis	535.3	61	61	100
Alcoholic fatty liver	571.0	1,077	1,077	100
Acute alcoholic hepatitis	571.1	766	766	100
Alcoholic cirrhosis of the liver	571.2	7,466	7,466	100
Alcoholic liver damage, unspecified	571.3	1,979	1,979	100
Excessive blood level of alcohol	790.3	12	12	100
Accidental poisoning by alcoholic beverages and other and unspecified products	E860.0-860.1	175	175	100
Alcohol-Related Causes			77,157	
Malignant Neoplasms			15,883	
Lip, tongue, oral cavity, pharynx	140-149	8,290	3,896	47
Esophagus	150	8,613	6,460	75
Stomach	151	13,951	2,790	20
Liver and intrahepatic bile ducts	155	6,809	1,021	15
Larynx	161	3,502	1,716	49
Injuries and Accidents			34,863	
Motor vehicle traffic accidents	E810-825	45,866	23,190	51
Nontraffic and other road vehicle accidents	E825,826,829	382	76	20
Water transport accidents	E830-838	1,108	388	35
Air and space transport accidents	E840-845	1,428	143	10
Accidental falls	E880-888	11,997	4,919	41
Accidents caused by fires and flames	E890-899	4,922	2,067	42
Accidental drowning and submersion	E910	6,170	1,851	30
All other	E867-869, E900-909, E911-929	20,259	2,229	11

TABLE 47 (cont'd)

Cause of Death	ICD-9-CM Code	Total Number	Attributable to Alcohol	
			Number	Percent
Violence			12,157	
Suicide	E950-959	29,446	3,828*	13*
Homicide & legal intervention	E960-978	19,830	8,329	42
Other Alcohol-Related Causes			14,254	
Respiratory tuberculosis	011-012	1,367	342	25
Diabetes mellitus	250	36,961	1,848	5
Pneumonia & influenza	480-487	67,564	3,378	5
Diseases of esophagus, stomach, duodenum	530-537	9,434**	943	10
Cirrhosis without mention of alcohol	571.5-571.6	13,333	6,667	50
Acute pancreatitis	577.0	2,236	917	41
Chronic pancreatitis	577.1	237	159	67

* Excludes 3,828 suicides to avoid double counting. Studies show that 26 percent of the deaths due to suicides are alcohol related. All suicides are classified as deaths due to mental disorders by NIMH. To avoid double counting, the 26 percent (7,656 deaths) are distributed as follows: half are classified as alcohol related and an equal number are deducted from deaths due to mental illness (see Table 49).

** Excludes 61 deaths due to alcoholic gastritis (535.3) listed as main cause.

SOURCES: Percents attributable to alcohol: National Institute on Alcohol Abuse and Alcoholism staff and Parker et al., 1985; Ravenholt, 1984; Roizen, 1985.

Number of deaths: 1985 NCHS Summary Vital Statistics public use tapes.

NOTE: Excludes deaths with age not stated.

Table 48

NUMBER OF DRUG ABUSE DEATHS BY CAUSE OF DEATH, 1985

<u>Cause of Death</u>	<u>ICD-9-CM</u>	<u>Number</u>
Total		6,118
Drug psychoses	292	11
Drug dependence	304	1,165
Nondependent abuse of drugs	305.1-305.9	524
Drug withdrawal syndrome in newborn	779.5	1
Accidental poisoning by drugs, medicaments, and biologicals	E850-859	3,552
Heroin, methadone, other opiates and related narcotics, and other drugs causing adverse effects in therapeutic use	E935.0-935.2, E937-940	33
Injury undetermined whether accidentally or purposely inflicted from poisoning by drugs, medicaments, and other	E980	832

SOURCES: National Institute on Drug Abuse and 1985 NCHS Summary Vital Statistics public use tapes.

the Fatal Accident Reporting System (National Highway Traffic Safety Administration, 1987).

The total number of alcohol-related deaths is understated by 3,378. Studies show that 26 percent of the 29,446 suicides deaths in 1985 are alcohol-related (Parker et al., 1987). All suicides, however, are classified by the National Institute of Mental Health (NIMH) as deaths related to mental illness. To avoid double counting in the total number of ADM deaths, the 26 percent (7,656 deaths) is distributed as follows: half (3,828) is classified as alcohol-related and an equal number is deducted from deaths due to mental illness.

A total of 6,118 deaths in 1985 are due to drug abuse, and 39,707 are due to mental illness. The specific causes of death included in these categories are shown in Tables 48 and 49. In total, 140,593 deaths are due to alcohol and drug abuse and mental illness. This total represents 6.7 percent of the 2.1 million deaths in the United States in 1985.

ESTIMATING MORTALITY COSTS

As noted above, the expected value of future earnings lost must be calculated to obtain ADM mortality costs. Unlike other indirect morbidity costs based on losses of current earnings, mortality costs include the earnings losses in future years to take into account the value of losses to society resulting from premature death. The economic variables used for estimating lifetime earnings are summarized below and shown in Table 50.

Employment

The estimate of lifetime earnings takes into account varying labor force participation rates. The assumption is that people will be working and productive during their expected lifetimes in accordance with the current pattern of work experience for their sex and age groups. For this calculation, the percent of the population with earnings in 1985 published by the U.S. Bureau of the Census was used.

There is considerable evidence that a radical change has taken place in recent years in many dimensions of labor supply. More than one-half of the women of working age are now employed compared with about one-third in the early 1950s. Each successive cohort of women has higher levels and more continuous patterns of labor force participation than the preceding one. For each age group, however, a significantly higher proportion of men than of women were employed in 1985, with the highest proportion at ages 35-39 years -- 94.8 percent for men and 75.6 percent for women. The largest differential, however, is in the 50-54 age group, in which 90.5 percent of the men compared with 65.4 percent of the women were employed and had earnings in 1985.

Earnings

Output losses are based on annual mean earnings by age and sex, adjusted for wage supplements such as employer contributions for social insurance, private pensions, and welfare funds. Cross-sectional profiles of mean earnings by age and sex are employed to estimate lifetime earnings. In applying these data, it is assumed that the future pattern of earnings for an average

Table 49

NUMBER OF MENTAL ILLNESS DEATHS BY CAUSE OF DEATH, 1985

<u>Cause of Death</u>	<u>ICD-9-CM Code</u>	<u>Number</u>
Total		39,707*
Psychoses		5,494
Senile and presenile organic psychotic conditions	290	3,810
All other psychoses except drug-induced	293-299	1,686
Neurotic, Personality and Other Nonpsychotic Mental Disorders		5,738
Neurotic disorders	300	67
Sexual deviations and disorders	302	1
Physiological malfunction arising from mental disorders	306	20
Special symptoms or syndromes, not elsewhere classified	307	172
Acute reaction to stress and adjustment reaction	308-309	62
Specific nonpsychotic mental disorders due to organic brain damage	310	5,152
Depressive disorders and disturbance of conduct	311-312	257
Hyperkinetic syndrome of childhood and specific delays in development	314-315	7
Other		28,475
Mental retardation - specified and unspecified	317-319	360
Down's, Patau's, Edwards', autosomal deletion syndromes	758.0-758.3	987
Senility without mention of psychosis	797	1,349
Suicide	E950-959	25,625*
Child battering and other maltreatment	E967	154

* Excludes 3,828 suicides to avoid double counting of the number of suicides classified as alcohol related.

SOURCES: National Institute on Mental Health and 1985 NCHS Summary Vital Statistics public use tapes.

SELECTED ECONOMIC VARIABLES USED IN ESTIMATING MORTALITY COSTS
BY AGE AND SEX, 1985

Age Group	Percent of Population with Earnings		Mean Annual Earnings[1]		Mean Annual Value of Housekeeping Services[2]			
	Male	Female	Male	Female	In Labor Force		Not in Labor Force	
					Male	Female	Male	Female
15 - 19	44.9	41.5	\$ 6,706	\$ 6,353	\$1,835	\$4,691	\$3,611	\$ 9,330
20 - 24	85.0	71.8	19,357	16,030	2,220	7,076	4,706	11,715
25 - 29	94.1	75.5	25,771	19,702	2,604	7,862	5,091	12,396
30 - 34	94.4	74.1	30,950	22,268	2,871	8,491	5,327	13,130
35 - 39	94.8	75.6	36,075	22,077	2,960	8,911	5,446	13,549
40 - 44	93.5	75.4	38,856	21,642	2,989	8,282	5,475	12,920
45 - 49	93.2	73.0	38,884	21,252	2,989	7,469	5,475	12,108
50 - 54	90.5	65.4	37,497	20,476	2,989	7,469	5,475	12,108
55 - 59	82.0	55.7	35,936	19,878	3,196	7,338	5,682	12,029
60 - 64	62.6	40.3	35,409	19,270	3,196	7,338	5,682	12,029
65 - 69	24.6	13.3	33,412	19,552	3,196	7,155	5,712	11,793
70 - 74	12.9	5.5	27,898	16,529	2,276	5,094	4,067	8,397
75 - 79	8.4	3.0	23,284	13,988	1,547	3,464	2,766	5,710
80 - 84	5.5	1.5	19,418	11,824	899	2,013	1,607	3,317
85 and Over	3.5	1.0	16,212	9,999	509	1,139	909	1,878

[1] Mean annual earnings for year-round full-time workers, including supplements, consisting mainly of employer's contributions to social insurance.

[2] Values are imputed by multiplying hours spent in each type of domestic activity by the wages for corresponding occupations.

SOURCES: U.S. Bureau of the Census, 1985, Tables 34 and 36; U.S. Department of Labor, 1986, Table 3.

Table 51

Present Value of Lifetime Earnings by Age, Sex, and Discount Rate, 1985

Age	Males			Females		
	4 percent	6 percent	10 percent	4 percent	6 percent	10 percent
Under 1 yr.	\$421,235	\$208,631	\$60,806	\$341,574	\$173,738	\$53,831
1-4	454,561	236,117	75,494	368,388	196,515	66,797
5-9	519,459	293,977	111,042	420,790	244,559	98,205
10-14	602,092	374,790	170,371	487,557	311,678	150,622
15-19	689,576	468,782	251,439	552,141	384,026	217,161
20-24	745,680	541,021	324,215	578,481	425,804	264,945
25-29	749,695	568,546	363,750	558,019	424,982	277,578
30-34	717,630	565,043	381,607	513,796	402,176	272,561
35-39	653,498	532,289	377,822	454,897	364,873	255,422
40-44	561,016	471,190	350,066	388,555	319,090	230,617
45-49	450,452	389,462	302,591	319,279	268,529	200,822
50-54	331,478	294,646	239,410	249,422	214,826	166,546
55-59	213,719	194,878	165,416	181,151	159,614	128,340
60-64	108,880	101,085	88,714	117,333	105,272	87,226
65-69	42,879	39,713	34,679	67,346	61,103	51,510
70-74	19,176	17,802	15,581	36,593	33,574	28,792
75-79	9,383	8,789	7,802	18,847	17,531	15,372
80-84	4,698	4,457	4,037	9,164	8,655	7,773
85 & Over	1,442	1,408	1,344	2,311	2,257	2,155

SOURCE: Estimated by the authors.

individual within a sex group will follow the pattern reported by the Bureau of the Census during a base year. This model requires that the average individual may expect his or her earnings to rise with age and experience in accordance with the cross-sectional data for that year.

The differentials in earnings continue to be large between the sexes. As indicated in Table 50, male earnings are higher for each age group, ranging from 6 percent for the youngest working ages to 83 percent for ages 45-54. Use of higher labor force participation rates and higher earnings for men in measuring output losses has a significant impact on the economic costs of illness for men and women.

Valuing Household Services

As noted in Chapter II, marketplace earnings underestimate the loss resulting from women's illnesses because many women and some men are not in the labor force and keep house. The value of household work, therefore, must be added to earnings. Walker and Gauger (1980) provide estimates of the value of primary and secondary household production based on time-motion studies of housekeepers multiplied by the relevant market wages for various services performed. Valuation is calculated on a task by task basis. The value of housekeeping services for women not in the labor force as well as for employed men and women is estimated.

Peskin (1984) uses a somewhat different estimation technique. Like Walker and Gauger, her methodology involves calculating the mean time inputs for men and women who keep house and valuing the contributions by specific tasks performed with the prevailing wage rate for performance of similar tasks. The data are analyzed in a regression framework to control for socioeconomic and demographic factors. A recent unpublished review of these and other studies by Kenney (1987) concludes that the Peskin estimates are the best available.

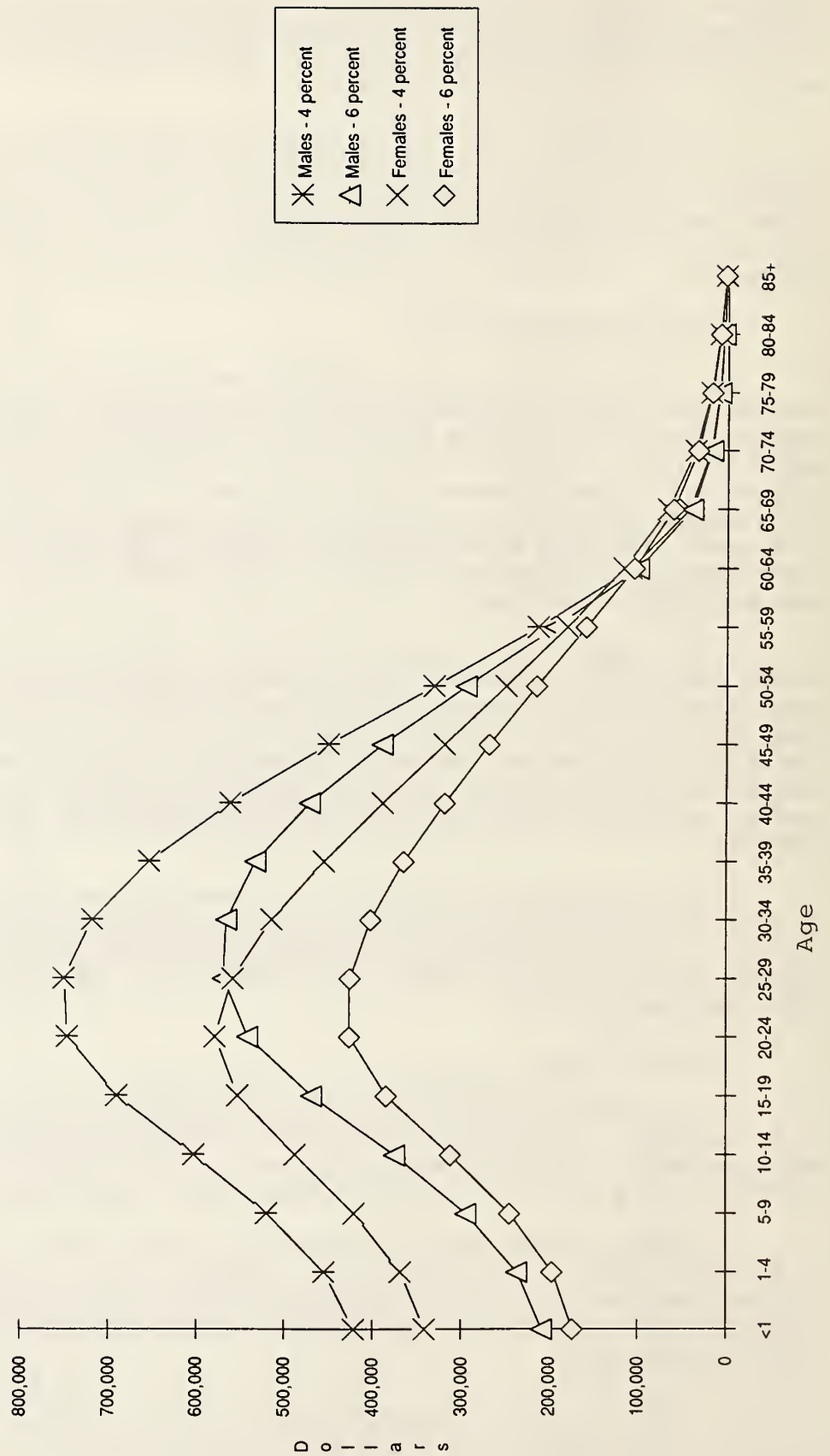
In the current study, Ted Miller of The Urban Institute updates the Peskin estimates of household production. He substitutes 1985 data on family structure, education, income, and race into the regression equation developed by Peskin to estimate hours spent on household labor. The hours are valued on the basis of 1985 wage rates by activity.

Discount Rates

The arithmetic sum of lifetime earnings overstates the current year value of an individual. Determining the present discounted value of the future earnings stream is the correct way to measure economic value over a period of time; discounting converts a stream of earnings into its present value.

The higher the discount rate, the lower the present value of a given stream of earnings. With a high discount rate, earnings far into the future yield a relatively small present value. Conversely, lowering the discount rate increases the present value of future earnings. For this study, three discount rates are used -- 4, 6, and 10 percent.

Figure 19
Present Value of Lifetime Earnings by Age, Sex, and
Discount Rate, 1985



Future Productivity Changes

In estimating the present value of lifetime earnings, future changes in productivity of wage earners need to be taken in to account. Real average hourly compensation in nonfarm business and the business sector have fluctuated widely during the past three decades. During the 1960s, the annual rate of increase ranged between 1.7 and 2.8 percent. During the 1970s, the annual increase was less than 1 percent. Between 1980 and 1986, changes in hourly earnings ranged from a decline of 2.7 percent to a 1.5 percent annual increase (U.S. Bureau of the Census, 1987c, Table 644).

In earlier estimates of lifetime earnings, Rice (1966; Cooper and Rice, 1976; Rice et al., 1985) assumed a 2 percent annual rate of increase. Because of the lower rate of increase in productivity in recent years, a 1 percent annual increase is assumed in the present study, a more conservative estimate than that employed previously.

FINDINGS

Lifetime Earnings

The present values of lifetime earnings by age and sex for discount rates of 4, 6, and 10 percent are shown in Table 51 and Figure 19. For a male infant under age 1, the expected lifetime earnings discounted at 6 percent are \$208,631. The present value of male lifetime earnings reaches a peak of \$568,546 for the 25-29 age group, and decreases steadily to \$1,408 for men aged 85 or over.

The level of expected lifetime earnings for women is somewhat lower than that for men up to age 59. At a 6 percent discount rate, the present value of lifetime earnings for a female infant is \$173,738, or 83 percent of that for men. For women, the highest expected lifetime earnings, \$425,804, are in the 20-24 age group. Peak male earnings are about 34 percent higher than those for women.

Beginning with the 60-64 age group, female earnings are higher than male earnings. Discounted at 6 percent, the present value of lifetime earnings for females in this age group is \$105,272 compared with \$101,085 for males. At ages 85 and over, female lifetime earnings are valued at \$2,257 compared with \$1,408 for males. The higher expected earnings for females in the older age groups are the result of the relatively smaller number of males in the labor force and the larger number of females keeping house.

Application of a 4 percent discount rate results in a similar pattern, but with somewhat higher figures, while the 10 percent discount rate results in lower values. Although mortality costs were estimated for the three discount rates, the summary tables and discussion will be limited to the costs based on a 6 percent discount rate to enable comparisons with the mortality costs estimates made by RTI for earlier years.

Person Years Lost

Person years lost are estimated on the basis of life expectancy at age of death for men and women. Life expectancy for the middle year of each 5-year age group after age 5 is shown in Table 52. To obtain the number of person years

TABLE 52

LIFE EXPECTANCY IN YEARS BY AGE AND SEX, 1985

Age	Both Sexes	Males	Females
Under 1 yr.	74.6	71.2	78.1
1-4	73.1	69.7	76.5
5-9	68.7	65.3	72.1
10-14	63.8	60.3	67.2
15-19	58.9	55.5	62.3
20-24	54.2	50.9	57.4
25-29	49.5	46.3	52.6
30-34	44.8	41.7	47.7
35-39	40.1	37.1	42.9
40-44	35.5	32.5	38.2
45-49	31.0	28.1	33.6
50-54	26.6	23.9	29.1
55-59	22.6	20.1	24.9
60-64	18.8	16.5	20.8
65-69	15.4	13.3	17.1
70-74	12.3	10.5	13.6
75-79	9.5	8.1	10.5
80-84	7.2	6.1	7.8
85 & Over	6.0	5.1	6.4

SOURCE: National Center for Health Statistics, 1988b.

lost, the number of deaths in each sex and age group is multiplied by the life expectancy for that group.

Mortality Costs

Tables 53 - 56 show the number of deaths, person years lost, and discounted productivity losses by 5-year age groups and sex for all ADM deaths and for alcohol abuse, drug abuse, and mental illness separately. Productivity losses are shown for three discount rates -- 4, 6, and 10 percent. Tables 57 - 60 aggregate the data into the following age groups: under 15 years, 15-24, 25-44, 45-64, and 65 years and over. Productivity losses are shown only at a 6 percent discount rate in Tables 57 - 60.

Applying expected lifetime earnings by age and sex to the 140,593 ADM deaths in 1985 results in a loss of approximately 4 million person years, or 28 years per death. These represent a loss of \$35.8 billion to the economy at a 6 percent discount rate, or \$254,716 per death. For the almost 95,000 men who died from ADM causes in 1985, the estimated loss is \$28.6 billion, or \$301,570 per death. About 45,600 women died from ADM causes, representing a loss of 1.2 million person years, or 26 years per death. Because of the fewer deaths and lower earnings of women, losses for women are significantly lower than for men, amounting to a total of \$7.2 billion, or \$157,145 per death. Thus, men account for 68 percent of the ADM deaths, 70 percent of the person years lost, and 80 percent of the productivity losses for 1985 (Figure 20).

The number of ADM deaths, person years lost, and discounted earnings varies by age: among the deaths under age 65, the highest number and proportion of ADM deaths are among those aged 25-44 years, representing one-fourth of the total. The total of person years lost for this age group, a function of both age and number of deaths, represents 37 percent of the person years lost. In terms of lost earnings, this age group accounts for 50 percent of the total. By contrast, ADM deaths at age 65 years and over represent 35 percent of the total. Since persons in this age group would have had relatively fewer remaining years of life, their deaths account for 12 percent of the total person years lost and only 2 percent of the total ADM productivity losses (Figure 21).

Table 61 and Figure 22 summarize the ADM deaths and losses by diagnosis. Deaths due to alcohol abuse account for more than two-thirds (67 percent) of the total ADM deaths. Person years lost and productivity losses due to alcohol abuse deaths represent about the same proportions of the totals for ADM. Drug abuse deaths account for 4 percent of total ADM deaths, 6 percent of the total person years lost, and 7 percent of the total ADM productivity losses. The relatively higher proportions of productivity losses for drug abuse reflect the large number of deaths due to drug abuse in the younger age groups. Mental illness deaths, which occur at somewhat older ages, account for 28 percent of the total ADM deaths and 26 percent of the total ADM productivity losses.

Mortality from ADM and from All Causes

Deaths from all causes and from ADM are shown in Table 62 and Figure 23. ADM deaths comprise 7 percent of the 2.1 million deaths in the United States in 1985, 12 percent of the total person years lost, and 20 percent of the total productivity losses. The distribution by age of deaths from all causes and from ADM are significantly different. Less than 2 percent of all deaths are in the 15-24

TABLE 53

**ADM MORTALITY: NUMBER OF DEATHS, PERSON YEARS LOST, AND
DISCOUNTED PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

Age & Sex	Number of Deaths	Person Years Lost (thousands)	Productivity Losses Discounted at:		
			4 Percent (millions)	6 Percent (millions)	10 Percent (millions)
Total	140,593	3,955	\$45,866	\$35,811	\$24,389
Under 1 yr.	1,168	87	443	222	67
1-4	1,195	87	501	263	86
5-9	689	47	331	189	73
10-14	1,003	63	569	357	165
15-19	6,426	367	4,212	2,877	1,561
20-24	11,214	585	7,988	5,809	3,503
25-29	10,159	484	7,212	5,473	3,513
30-34	9,692	417	6,507	5,118	3,459
35-39	8,412	324	5,098	4,141	2,932
40-44	7,248	246	3,737	3,124	2,309
45-49	6,983	207	2,893	2,487	1,917
50-54	7,627	194	2,350	2,074	1,668
55-59	9,518	204	1,950	1,764	1,479
60-64	10,512	186	1,170	1,075	928
65-69	9,472	137	478	439	378
70-74	9,183	106	230	213	184
75-79	8,661	79	114	107	94
80-84	8,124	56	56	53	48
85 & Over	13,306	79	27	26	25
Males	94,984	2,756	36,660	28,644	19,485
Under 1 yr.	551	39	232	115	33
1-4	704	49	320	166	53
5-9	416	27	216	122	46
10-14	698	42	420	262	119
15-19	4,828	268	3,329	2,263	1,214
20-24	8,978	457	6,695	4,857	2,911
25-29	8,050	373	6,035	4,577	2,928
30-34	7,494	313	5,378	4,235	2,860
35-39	6,401	237	4,183	3,407	2,418
40-44	5,336	173	2,993	2,514	1,868
45-49	5,058	142	2,278	1,970	1,530
50-54	5,458	130	1,809	1,608	1,307
55-59	6,947	140	1,485	1,354	1,149
60-64	7,478	123	814	756	663
65-69	6,538	87	280	260	227
70-74	6,065	64	116	108	94
75-79	5,163	42	48	45	40
80-84	4,114	25	19	18	17
85 & Over	4,707	24	7	7	6
Females	45,608	1,199	9,206	7,167	4,904
Under 1 yr.	617	48	211	107	33
1-4	492	38	181	97	33
5-9	273	20	115	67	27
10-14	305	21	149	95	46
15-19	1,598	100	882	613	347
20-24	2,235	128	1,293	952	592
25-29	2,109	111	1,177	896	585
30-34	2,197	105	1,129	884	599
35-39	2,011	86	915	734	514
40-44	1,913	73	743	610	441
45-49	1,925	65	615	517	387
50-54	2,169	63	541	466	361
55-59	2,571	64	466	410	330
60-64	3,034	63	356	319	265
65-69	2,933	50	198	179	151
70-74	3,118	42	114	105	90
75-79	3,498	37	66	61	54
80-84	4,010	31	37	35	31
85 & Over	8,598	55	20	19	19

NOTE: Numbers may not add to totals due to rounding.

TABLE 54

**MORTALITY DUE TO ALCOHOL ABUSE: NUMBER OF DEATHS, PERSON YEARS
LOST, AND DISCOUNTED PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

Age & Sex	Number of Deaths	Person Years Lost (thousands)	Productivity Losses Discounted at:		
			4 Percent (millions)	6 Percent (millions)	10 Percent (millions)
Total	94,768	2,675	\$30,628	\$23,983	\$16,424
Under 1 yr.	324	24	125	62	19
1-4	1,011	73	425	223	73
5-9	624	42	301	172	66
10-14	716	45	406	254	118
15-19	4,658	267	3,043	2,079	1,129
20-24	7,843	410	5,576	4,055	2,446
25-29	6,078	290	4,306	3,268	2,098
30-34	5,570	240	3,734	2,937	1,985
35-39	5,152	199	3,112	2,528	1,790
40-44	4,891	166	2,527	2,113	1,562
45-49	5,046	149	2,095	1,802	1,389
50-54	5,861	149	1,808	1,596	1,284
55-59	7,517	161	1,541	1,394	1,169
60-64	8,558	152	953	876	756
65-69	7,562	110	383	352	303
70-74	6,826	79	172	159	138
75-79	5,800	53	76	71	63
80-84	4,670	32	32	30	27
85 & Over	6,058	36	12	12	11
Males	65,319	1,864	24,320	19,051	13,030
Under 1 yr.	178	13	75	37	11
1-4	607	42	276	143	46
5-9	389	25	202	114	43
10-14	496	30	299	186	85
15-19	3,427	190	2,363	1,607	862
20-24	6,213	316	4,633	3,361	2,014
25-29	4,772	221	3,578	2,713	1,736
30-34	4,278	178	3,070	2,417	1,633
35-39	3,872	144	2,530	2,061	1,463
40-44	3,634	118	2,039	1,712	1,272
45-49	3,693	104	1,664	1,438	1,118
50-54	4,221	101	1,399	1,244	1,010
55-59	5,510	111	1,178	1,074	912
60-64	6,069	100	661	614	538
65-69	5,158	69	221	205	179
70-74	4,462	47	86	79	70
75-79	3,473	28	33	31	27
80-84	2,445	15	11	11	10
85 & Over	2,420	12	3	3	3
Females	29,448	811	6,308	4,933	3,394
Under 1 yr.	146	11	50	25	8
1-4	405	31	149	80	27
5-9	236	17	99	58	23
10-14	220	15	107	68	33
15-19	1,231	77	680	473	267
20-24	1,630	94	943	694	432
25-29	1,306	69	729	555	362
30-34	1,292	62	664	520	352
35-39	1,280	55	582	467	327
40-44	1,257	48	489	401	290
45-49	1,352	45	432	363	272
50-54	1,640	48	409	352	273
55-59	2,006	50	363	320	258
60-64	2,489	52	292	262	217
65-69	2,404	41	162	147	124
70-74	2,364	32	86	79	68
75-79	2,327	24	44	41	36
80-84	2,225	17	20	19	17
85 & Over	3,638	23	8	8	8

NOTE: Numbers may not add to totals due to rounding.

TABLE 55

**MORTALITY DUE TO DRUG ABUSE: NUMBER OF DEATHS, PERSON YEARS
LOST, AND DISCOUNTED PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

Age & Gender	Number of Deaths	Person Years Lost (thousands)	Productivity Losses Discounted at:		
			4 Percent (millions)	6 Percent (millions)	10 Percent (millions)
Total	6,118	231	\$3,261	\$2,563	\$1,741
Under 1 yr.	14	1	5	3	1
1-4	29	2	12	6	2
5-9	9	1	4	2	1
10-14	9	1	5	3	1
15-19	109	6	69	47	26
20-24	452	24	315	229	139
25-29	1,089	52	769	583	375
30-34	1,442	62	971	763	516
35-39	1,004	38	616	501	355
40-44	472	16	241	202	149
45-49	308	9	124	106	82
50-54	202	5	59	52	41
55-59	191	4	38	34	28
60-64	164	3	19	17	14
65-69	137	2	7	7	6
70-74	145	2	4	4	3
75-79	118	1	2	2	1
80-84	113	1	1	1	1
85 & Over	111	1	0	0	0
Males	4,290	162	2,607	2,050	1,392
Under 1 yr.	6	0	3	1	0
1-4	18	1	8	4	1
5-9	2	0	1	1	0
10-14	4	0	2	1	1
15-19	63	3	43	30	16
20-24	320	16	239	173	104
25-29	840	39	630	478	306
30-34	1,127	47	809	637	430
35-39	804	30	525	428	304
40-44	335	11	188	158	117
45-49	196	6	88	76	59
50-54	104	2	34	31	25
55-59	101	2	22	20	17
60-64	84	1	9	8	7
65-69	74	1	3	3	3
70-74	66	1	1	1	1
75-79	58	0	1	1	0
80-84	48	0	0	0	0
85 & Over	40	0	0	0	0
Females	1,828	69	654	512	350
Under 1 yr.	8	1	3	1	0
1-4	11	1	4	2	1
5-9	7	1	3	2	1
10-14	5	0	2	2	1
15-19	46	3	25	18	10
20-24	132	8	76	56	35
25-29	249	13	139	106	69
30-34	315	15	162	127	86
35-39	200	9	91	73	51
40-44	137	5	53	44	32
45-49	112	4	36	30	22
50-54	98	3	24	21	16
55-59	90	2	16	14	12
60-64	80	2	9	8	7
65-69	63	1	4	4	3
70-74	79	1	3	3	2
75-79	60	1	1	1	1
80-84	65	1	1	1	1
85 & Over	71	0	0	0	0

NOTE: Numbers may not add to totals due to rounding.

TABLE 56

**MORTALITY DUE TO MENTAL ILLNESS: NUMBER OF DEATHS, PERSON YEARS
LOST, AND DISCOUNTED PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

Age & Gender	Number of Deaths	Person Years Lost (thousands)	Productivity Losses Discounted at:		
			4 Percent (millions)	6 Percent (millions)	10 Percent (millions)
Both Sexes	39,707	1,049	\$11,977	\$9,265	\$6,223
Under 1 yr.	830	62	313	157	47
1-4	155	11	64	34	11
5-9	56	4	26	15	6
10-14	278	17	158	99	46
15-19	1,659	94	1,100	750	406
20-24	2,919	152	2,097	1,525	918
25-29	2,992	142	2,137	1,621	1,040
30-34	2,679	115	1,803	1,418	958
35-39	2,256	87	1,369	1,112	788
40-44	1,885	64	968	809	598
45-49	1,629	48	674	579	446
50-54	1,564	40	483	427	343
55-59	1,810	39	371	336	282
60-64	1,790	32	199	183	158
65-69	1,772	25	87	80	69
70-74	2,212	25	54	50	43
75-79	2,742	25	36	34	30
80-84	3,341	23	23	22	20
85 & Over	7,137	43	15	14	14
Males	25,375	729	9,733	7,543	5,063
Under 1 yr.	367	26	155	77	22
1-4	79	6	36	19	6
5-9	26	2	13	8	3
10-14	198	12	119	74	34
15-19	1,338	74	923	627	336
20-24	2,445	124	1,824	1,323	793
25-29	2,437	113	1,827	1,386	887
30-34	2,089	87	1,499	1,181	797
35-39	1,725	64	1,128	918	652
40-44	1,367	44	767	644	479
45-49	1,168	33	526	455	354
50-54	1,133	27	376	334	271
55-59	1,335	27	285	260	221
60-64	1,324	22	144	134	117
65-69	1,306	17	56	52	45
70-74	1,536	16	29	27	24
75-79	1,631	13	15	14	13
80-84	1,621	10	8	7	7
85 & Over	2,247	11	3	3	3
Females	14,332	320	2,244	1,722	1,160
Under 1 yr.	463	36	158	80	25
1-4	76	6	28	15	5
5-9	30	2	13	7	3
10-14	81	5	39	25	12
15-19	321	20	177	123	70
20-24	473	27	274	201	125
25-29	554	29	309	236	154
30-34	590	28	303	237	161
35-39	531	23	242	194	136
40-44	518	20	201	165	120
45-49	461	15	147	124	93
50-54	431	13	108	93	72
55-59	475	12	86	76	61
60-64	466	10	55	49	41
65-69	466	8	31	28	24
70-74	675	9	25	23	19
75-79	1,111	12	21	19	17
80-84	1,720	13	16	15	13
85 & Over	4,889	31	11	11	11

NOTE: Numbers may not add to totals due to rounding.

TABLE 57

**ADM MORTALITY: NUMBER OF DEATHS, PERSON YEARS LOST,
AND PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

<i>Age & Sex</i>	<i>Number of Deaths</i>	<i>Person Years Lost</i>		<i>Productivity Losses [1]</i>	
		<i>Number (thousands)</i>	<i>Per Death</i>	<i>Amount (millions)</i>	<i>Per Death</i>
Both Sexes	140,593	3,955	28.1	\$35,811	\$254,716
Under 15	4,055	283	69.9	1,031	254,153
15-24	17,639	953	54.0	8,686	492,429
25-44	35,511	1,471	41.4	17,857	502,852
45-64	34,640	791	22.8	7,400	213,638
65 and over	48,745	457	9.4	837	17,178
Males	94,984	2,756	29.0	28,644	301,566
Under 15	2,369	158	66.5	665	280,758
15-24	13,807	725	52.5	7,121	515,759
25-44	27,281	1,096	40.2	14,733	540,035
45-64	24,940	536	21.5	5,688	228,052
65 and over	26,587	242	9.1	438	16,473
Females	45,608	1,199	26.3	7,167	157,145
Under 15	1,686	126	74.7	366	216,789
15-24	3,833	228	59.4	1,565	408,391
25-44	8,230	375	45.6	3,124	379,595
45-64	9,700	255	26.3	1,713	176,580
65 and over	22,158	216	9.7	399	18,024

NOTE: Numbers may not add to totals due to rounding.

[1] 6 percent discount rate.

TABLE 58

**ALCOHOL ABUSE MORTALITY: NUMBER OF DEATHS, PERSON
YEARS LOST, AND PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

<i>Age & Sex</i>	<i>Number of Deaths</i>	<i>Person Years Lost</i>		<i>Productivity Losses [1]</i>	
		<i>Number (thousands)</i>	<i>Per Death</i>	<i>Amount (millions)</i>	<i>Per Death</i>
Both Sexes	94,768 [2]	2,675	28.2	\$23,983	\$253,071
Under 15	2,675	184	68.9	712	265,973
15-24	12,501	677	54.1	6,135	490,735
25-44	21,691	894	41.2	10,846	500,043
45-64	26,981	610	22.6	5,667	210,039
65 and over	30,916	309	10.0	624	20,172
Males	65,319	1,864	28.5	19,051	291,661
Under 15	1,669	110	66.0	481	287,887
15-24	9,640	506	52.5	4,968	515,338
25-44	16,556	661	39.9	8,904	537,794
45-64	19,494	416	21.3	4,369	224,143
65 and over	17,958	171	9.5	329	18,327
Females	29,448	811	27.5	4,933	167,516
Under 15	1,006	74	73.7	231	229,611
15-24	2,861	170	59.5	1,167	407,831
25-44	5,135	233	45.4	1,943	378,330
45-64	7,487	195	26.0	1,298	173,317
65 and over	12,958	138	10.7	295	22,730

NOTE: Numbers may not add to totals due to rounding.

[1] 6 percent discount rate.

[2] Includes deaths with age unknown.

TABLE 59

**DRUG ABUSE MORTALITY: NUMBER OF DEATHS, PERSON YEARS
LOST, AND PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

<i>Age & Sex</i>	<i>Number of Deaths</i>	<i>Person Years Lost</i>		<i>Productivity Losses [1]</i>	
		<i>Number (thousands)</i>	<i>Per Death</i>	<i>Amount (millions)</i>	<i>Per Death</i>
Both Sexes	6,118	231	37.8	\$2,563	\$418,857
Under 15	61	4	71.5	14	236,244
15-24	561	30	53.9	277	492,926
25-44	4,007	169	42.1	2,049	511,452
45-64	865	22	25.4	209	241,696
65 and over	624	6	10.2	13	21,106
Males	4,290	162	37.9	2,050	477,969
Under 15	30	2	68.5	8	252,967
15-24	383	20	51.7	203	529,138
25-44	3,106	127	40.8	1,700	547,389
45-64	485	11	23.5	135	278,663
65 and over	286	3	9.2	5	17,111
Females	1,828	69	37.7	512	280,132
Under 15	31	2	74.4	7	220,060
15-24	178	10	58.7	74	415,007
25-44	901	42	46.5	349	387,565
45-64	380	11	27.7	74	194,514
65 and over	338	4	11.1	8	24,487

NOTE: Numbers may not add to totals due to rounding.
[1] 6 Percent Discount Rate

TABLE 60

**MENTAL ILLNESS MORTALITY: NUMBER OF DEATHS, PERSON
YEARS LOST, AND PRODUCTIVITY LOSSES BY AGE AND SEX, 1985**

<i>Age & Sex</i>	<i>Number of Deaths</i>	<i>Person Years Lost</i>		<i>Productivity Losses [1]</i>	
		<i>Number (thousands)</i>	<i>Per Death</i>	<i>Amount (millions)</i>	<i>Per Death</i>
Both Sexes	39,707	1,049	26.4	\$9,265	\$233,337
Under 15	1,319	95	71.9	305	231,007
15-24	4,577	246	53.7	2,275	496,993
25-44	9,813	408	41.6	4,961	505,551
45-64	6,794	158	23.3	1,524	224,363
65 and over	17,205	142	8.2	201	11,655
Males	25,375	729	28.7	7,543	297,253
Under 15	669	45	67.6	177	264,227
15-24	3,783	199	52.5	1,950	515,476
25-44	7,619	308	40.5	4,129	541,906
45-64	4,961	109	21.9	1,183	238,464
65 and over	8,343	68	8.2	104	12,461
Females	14,332	320	22.3	1,722	120,174
Under 15	650	50	76.3	128	196,773
15-24	794	47	59.4	325	408,924
25-44	2,194	100	45.5	832	379,284
45-64	1,833	50	27.0	341	186,194
65 and over	8,862	74	8.3	97	10,896

NOTE: Numbers may not add to totals due to rounding.
[1] 6 percent discount rate.

TABLE 61

**ADM MORTALITY: NUMBER OF DEATHS, PERSON YEARS LOST, AND
PRODUCTIVITY LOSSES BY DISORDER AND SEX, 1985**

<i>Age, Sex & Disorder</i>	<i>Number of Deaths</i>	<i>Person Years Lost</i>		<i>Productivity Losses [1]</i>	
		<i>Number (thousands)</i>	<i>Per Death</i>	<i>Amount (millions)</i>	<i>Per Death</i>
Both Sexes	140,593	3,955	28.1	\$35,811	\$254,716
Alcohol Abuse	94,768	2,675	28.2	23,983	\$253,071
Drug Abuse	6,118	231	37.8	2,563	\$418,857
Mental Illness	39,707	1,049	26.4	9,265	\$233,337
Males	94,984	2,756	29.0	28,644	\$301,566
Alcohol Abuse	65,319	1,864	28.5	19,051	\$291,661
Drug Abuse	4,290	162	37.9	2,050	\$477,969
Mental Illness	25,375	729	28.7	7,543	\$297,253
Females	45,608	1,199	26.3	7,167	\$157,145
Alcohol Abuse	29,448	811	27.5	4,933	\$167,516
Drug Abuse	1,828	69	37.7	512	\$280,132
Mental Illness	14,332	320	22.3	1,722	\$120,174

NOTE: Numbers may not add to totals due to rounding.
[1] 6 percent discount rate.

TABLE 62

TOTAL AND ADM MORTALITY: NUMBER OF DEATHS, PERSON YEARS
LOST, AND PRODUCTIVITY LOSSES BY AGE AND SEX, 1985

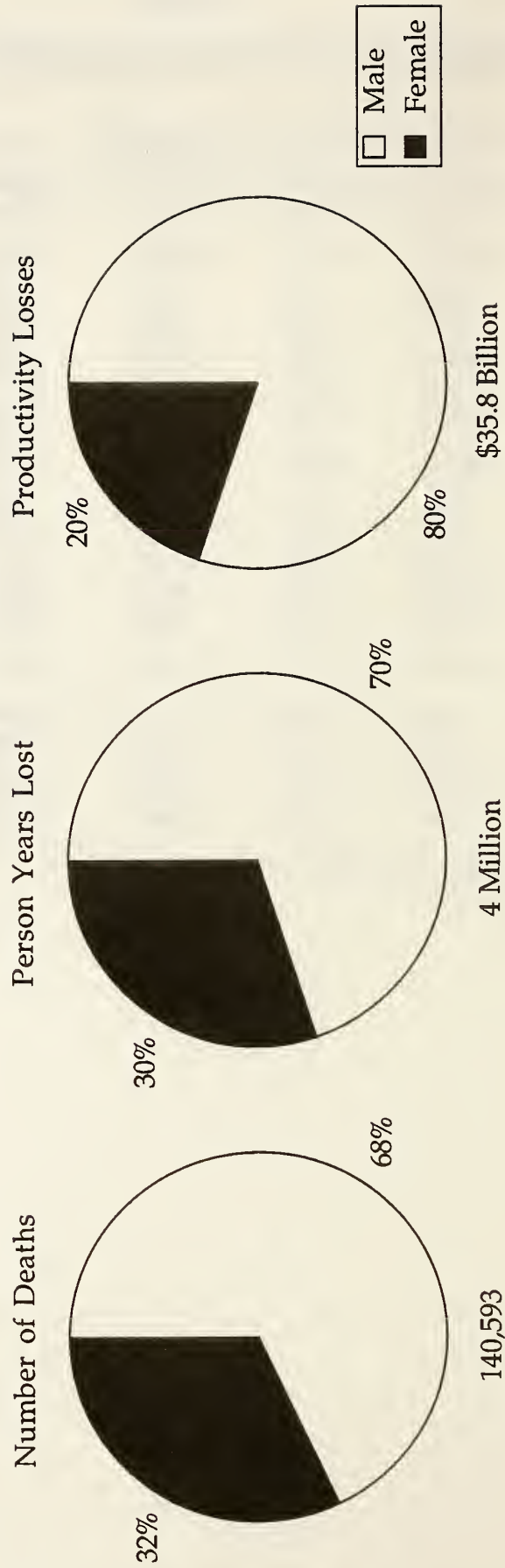
Age & Sex	All Deaths			ADM Deaths		
	Number of Deaths	Person Years Lost (thousands)	Productivity Losses [1] (millions)	Number of Deaths	Person Years Lost (thousands)	Productivity Losses [1] (millions)
Both Sexes	2,085,563	33,253	\$183,643	140,593	3,955	\$35,811
Under 15	56,302	4,084	12,183	4,055	283	1,031
15-24	37,935	2,065	18,438	17,639	953	8,686
25-44	117,667	4,772	56,475	35,511	1,471	17,857
45-64	403,114	8,843	73,115	34,640	791	7,400
65 and over	1,470,545	13,490	23,431	48,745	457	837
Males	1,097,267	18,044	124,134	94,984	2,756	28,644
Under 15	32,684	2,273	7,650	2,369	158	665
15-24	28,162	1,483	14,454	13,807	725	7,121
25-44	80,848	3,150	42,921	27,281	1,096	14,733
45-64	251,031	5,067	49,108	24,940	536	5,688
65 and over	704,542	6,071	10,001	26,587	242	438
Females	988,296	15,209	59,509	45,608	1,199	7,167
Under 15	23,618	1,811	4,533	1,686	126	366
15-24	9,773	582	3,984	3,833	228	1,565
25-44	36,819	1,623	13,554	8,230	375	3,124
45-64	152,083	3,776	24,007	9,700	255	1,713
65 and over	766,003	7,418	13,431	22,158	216	399

NOTE: Numbers may not add to totals due to rounding.

[1] 6 percent discount rate.

Figure 20

ADM Mortality Losses by Sex, 1985



age group, and 6 percent are in the 25-44 age group. By contrast, 13 percent and 25 percent of the ADM deaths are in the 15-24 and 25-44 age groups, respectively. It is clear that ADM deaths comprise a disproportionately larger share of deaths at the younger age groups compared with deaths from all causes. ADM deaths comprise almost half, 46 percent, of all deaths of persons aged 15-24 and 30 percent of the deaths of persons aged 25-44. For these age groups, ADM person years lost and ADM productivity losses represent about the same proportions of the total losses for all deaths. Premature deaths due to ADM are extremely costly to the nation.

Figure 21

ADM Mortality Losses by Age, 1985

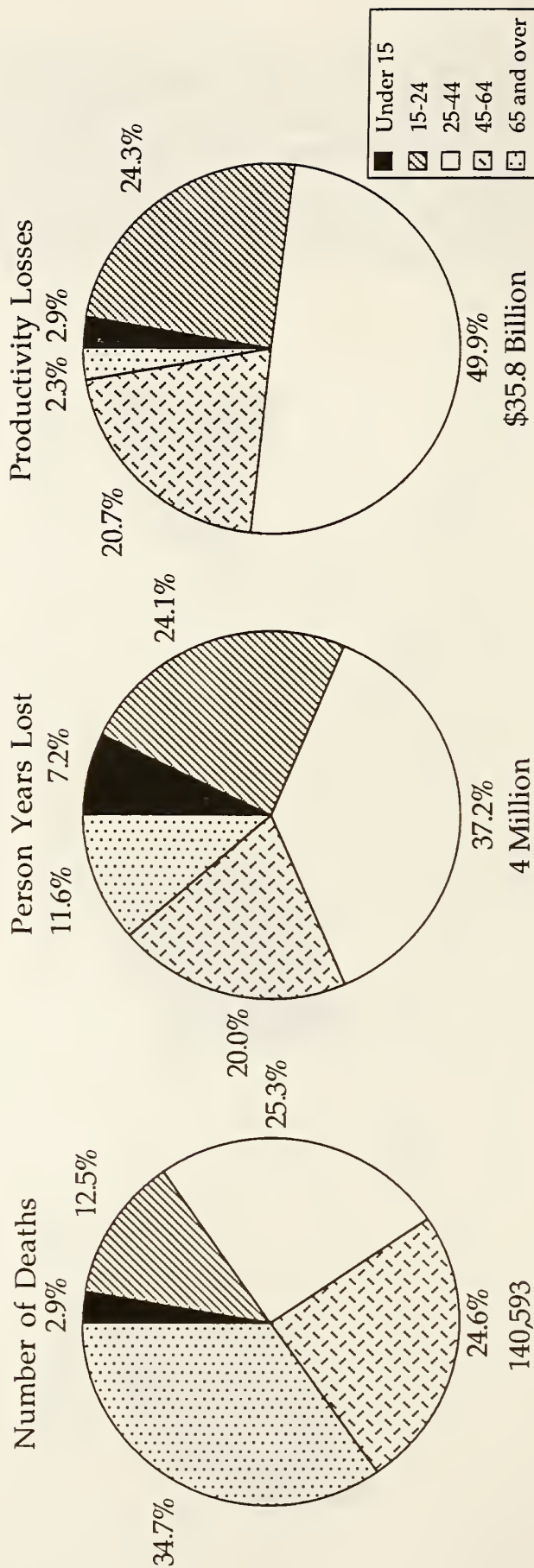


Figure 22

ADM Mortality Losses by Disorder, 1985

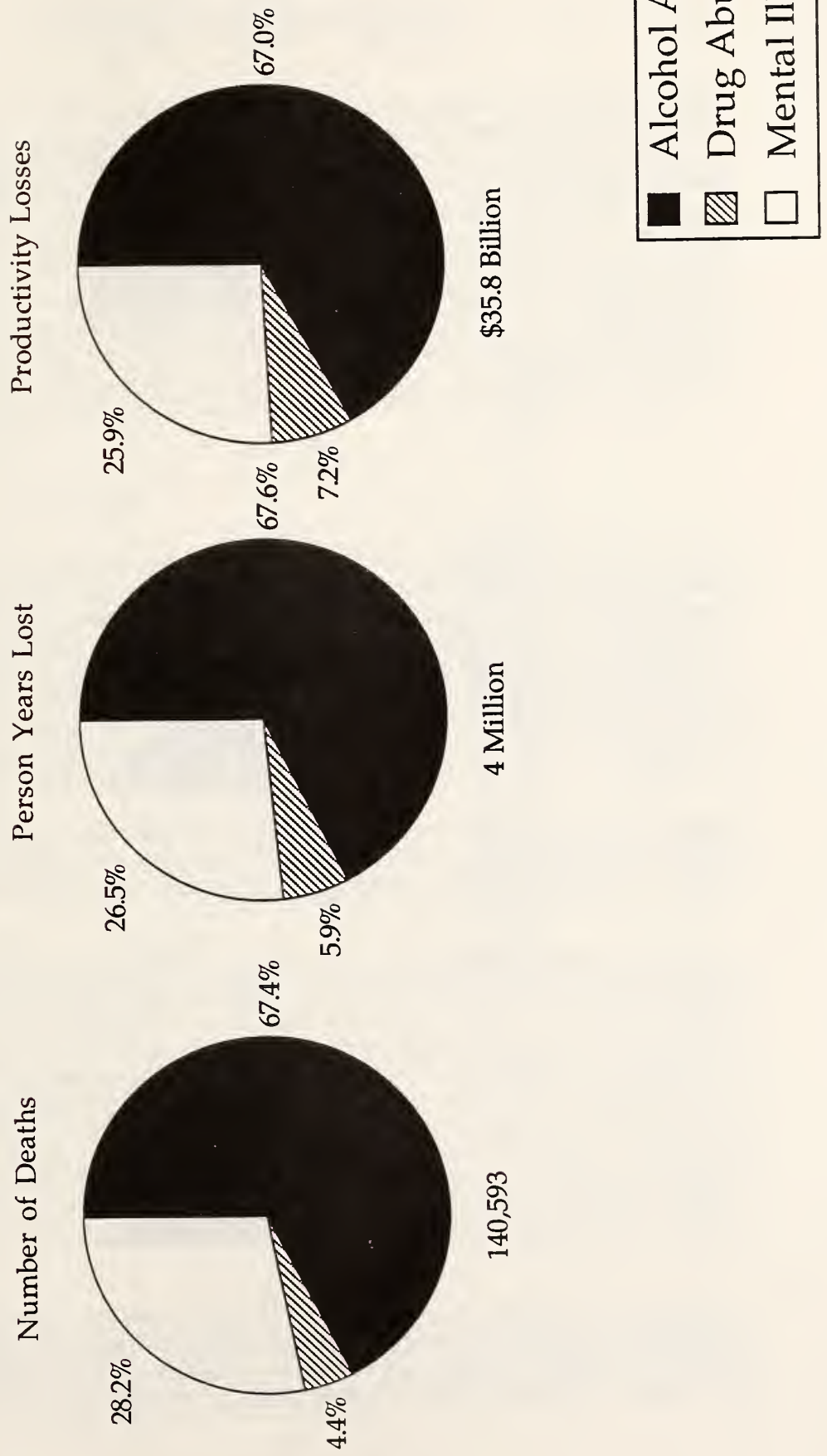


Figure 23

Total and ADM Mortality Losses
as Percent of Total, 1985



CHAPTER VI

OTHER RELATED COSTS

Other related direct costs of alcohol and drug abuse and mental illness (ADM) include public and private expenditures for crime, motor vehicle crashes, social welfare program administrative costs, and costs associated with the destruction of property by fire. Indirect costs include the value of productivity losses due to the following: 1) victimization by crime, 2) incarceration for a criminal offense, 3) time spent by heroin and cocaine addicts in criminal activities (crime careers) rather than legal employment, and 4) time spent to care for family members because of their mental illness (data on family caregiving for alcohol and drug abusers are unavailable). Costs attributable to alcohol, drug abuse, and mental illness are summarized in Table 63 and discussed below. The methodology and sources of data used to derive each cost category are briefly summarized here and presented in Appendix D with more detailed tables for each expense category.

DIRECT COSTS

Total ADM direct costs amount to \$22.3 billion. Almost 85 percent of this expense, \$18.8 billion, is related to crime and includes the public criminal justice system and drug traffic control expenses, private expenditures for legal defense, and the value of property destroyed as a result of violent and personal crimes due to alcohol and drug abuse. Other direct costs total \$3.5 billion, 16 percent of the total other related direct costs of ADM. Included are the value of losses due to motor vehicle crashes and fire destruction associated with ADM. Also included are the quantifiable administrative costs for public social welfare programs associated with ADM.

Public expenditures for ADM illnesses associated with the criminal justice system and drug traffic control amount to \$15.8 billion. Of this total, \$3.7 billion is related to alcohol abuse, \$11.1 billion to drug abuse, and \$968 million to mental illness.

Total criminal justice system expenditures for 1985 are estimated at \$45.6 billion (U.S. Department of Justice, 1987b). Criminal justice system costs include expenditures for police protection, legal and judicial services, and state, federal and local correctional institutions. The total expenditures by type of expenditure and the amount and percentage due to ADM are shown in Table 64. Almost one-third of the \$45.6 billion is estimated to be associated with ADM. Expenses for police protection equal \$22 billion, representing almost half of the total criminal justice system expenses. Of this total, 35 percent is ADM-related. State and federal correction costs are \$8.8 billion, and 34 percent is due to ADM. Almost half (43 percent) of the expenses for local correctional facilities are ADM-related. Appendix Tables D-1 through D-4 present a more detailed itemization of these costs.

Federal drug control expenditures for 1985 are estimated at \$1.6 billion (excluding costs for the criminal justice system and drug treatment programs). Drug law enforcement and control of drug traffic involve numerous federal agencies. In addition to the Drug Enforcement Administration within the

Table 63

OTHER RELATED DIRECT AND INDIRECT COSTS
BY TYPE OF COST AND DIAGNOSIS, 1985
(millions)

<u>Type of Cost</u>	<u>Total ADM</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Total	\$47,510	\$10,546	\$32,461	\$4,503
Direct Costs	22,267	7,380	13,209	1,678
Crime	18,755	4,251	13,203	1,301
Public Expenditures	15,765	3,734	11,063	968
Criminal Justice System	14,210	3,734	9,508	968
Police Protection	7,736	1,338	5,810	588
Legal and Adjudication	1,649	274	1,108	267
State and Federal Correction	3,014	884	2,130	-
Local Correction	1,811	1,238	460	113
Drug Traffic Control	1,555	-	1,555	-
Prevention	175	-	175	-
Law Enforcement	1,380	-	1,380	-
Private Legal Defense	2,056	342	1,381	333
Property Destruction	934	175	759	-
Other Direct Expenditures	3,512	3,129	6	377
Motor Vehicle Crashes	2,584	2,584	-	-
Fire Destruction	457	457	-	-
Social Welfare Administration	471	88	6	377
Indirect Costs	25,243	3,166	19,252	2,825
Victims of Crime	1,307	465	842	-
Incarceration	7,460	2,701	4,434	325
Crime Careers	13,976	-	13,976	-
Family Caregivers	2,500	-	-	2,500

SOURCE: U.S. Department of Justice, 1987a.

Department of Justice, federal funds for drug control are distributed among agencies within the Departments of Agriculture, Defense, Education, Health and Human Services, Interior, Labor, State, Transportation, and Treasury (U.S. Office of Management and Budget, 1988).

The federal drug control effort involves a dual strategy aimed at simultaneously reducing the supply of drugs through law enforcement and the demand for drugs through drug abuse prevention and treatment programs. Law enforcement costs amount to \$1.4 billion (89 percent of the total), and prevention costs to \$175 million (Appendix Tables D-5 and D-6).

The total annual payroll for legal defense services for 1985 equals \$12.5 billion (U.S. Bureau of the Census, 1985). Of this amount, \$2.1 billion (17 percent) is estimated for the private defense of ADM-related crime. About two-thirds of this amount (\$1.4 billion) is for defense counsel for drug-related crimes. The methodology used to determine these costs is discussed in Appendix D.

Property destruction due to violent and personal crimes such as robbery, assault, burglary, larceny, and motor vehicle theft amount to \$3.9 billion for 1985 (U.S. Department of Justice, 1986b and 1987b). The total amount due to ADM is estimated at \$934 million (24 percent), of which \$175 million is related to alcohol abuse and \$759 million to drug abuse (Appendix Table D-7). The determination of these costs is based on the event-specific methodology developed by Cruze and associates (1981) and is discussed in detail in Appendix D.

In addition to crime, other direct cost elements include motor vehicle crashes, fire destruction, and social welfare program administration costs. Motor vehicle crash costs include legal and court fees, insurance administration, and vehicle damage. The total costs for 1985 are \$40.1 billion, of which \$2.6 billion (6.4 percent) is estimated as alcohol related (Appendix Table D-8). These costs are determined by applying the methodology developed by Cruze and associates (1981) to data from a study conducted by the National Highway Traffic Safety Administration (Blincoe, 1987).

The value of property loss due to incendiary or suspicious fires for 1985 equals \$6.4 billion (U.S. Bureau of the Census, 1987c). Berry and associates (1977) estimate that 7.1 percent of these fire costs are attributable to alcohol abuse. When this factor is applied to the total value of property loss, fire destruction due to alcohol abuse amounts to \$457 million.

The total administrative expenditures for public social welfare programs amount to \$8.2 billion for 1985 (Appendix Table D-9). Of this amount, \$471 million is attributable to ADM: \$88 million for alcohol abuse, \$6 million for drug abuse, and \$377 million for mental illness.

INDIRECT COSTS

Four types of other related indirect costs are estimated: 1) the value of lost work time for victims of crime, 2) productivity losses for individuals incarcerated in prisons as a result of conviction for an ADM-related crime, 3) productivity losses for those who, as a result of heroin or cocaine addiction, engage in crime as a career rather than in legal employment, and 4) the value of time spent to care for family members because of their mental illness.

Table 64

CRIMINAL JUSTICE SYSTEM EXPENDITURES BY TYPE OF EXPENDITURE, 1985

<u>Type of Expenditure</u>	<u>TOTAL</u>		<u>ADM</u>		<u>Percent ADM of Total</u>
	<u>Amount (millions)</u>	<u>Percent Distri- bution</u>	<u>Amount (millions)</u>	<u>Percent Distri- bution</u>	
Total	\$45,605	100.0	\$14,210	100.0	31.2
Police Protection	22,000	48.3	7,736	54.4	35.1
Legal Adjudication	10,000	22.1	1,649	11.6	16.4
State and Federal Corrections	8,787	19.3	3,014	21.2	34.3
Local Correction	4,246	9.3	1,811	12.7	42.7
Other Justice Activities	489	1.1	-	-	-

SOURCE: U.S. Department of Justice, 1987c.

The value of reduced productivity for victims of crime and those incarcerated in prisons is calculated using the methodology and crime/alcohol and crime/drug factors developed by Cruze and associates (1981). This methodology is discussed in detail in Appendix D. The total value of lost work time by victims of crime is estimated at \$1.3 billion, \$465 million for alcohol abuse and \$842 million for drug abuse (Appendix Table D-10) (U.S. Department of Justice, 1986a). The total value of lost productivity due to incarceration is estimated at \$7.5 billion (Appendix Tables D-11 and 12). Of this amount, 60 percent (\$4.4 billion) is due to drug abuse, 36 percent (\$2.7 billion) to alcohol abuse, and 4 percent (\$325 million) to mental illness. These estimates are developed from data provided by the fourth Annual Survey of Jails, the 1986 Survey of Inmates of State Correctional Facilities, and the 1986 Sourcebook of Criminal Justice Statistics (U.S. Department of Justice, 1986d).

The total value of lost productivity due to crime careers for both men and women is estimated at \$14 billion (Appendix Table D-13). This estimate is based on data from the 1985 National Household Survey on Drug Abuse (National Institute on Drug Abuse, 1988), and the National Narcotics Intelligence Consumers Committee (1988). A detailed discussion of the methodology is presented in Appendix D.

The value of time spent by caregivers for care provided to mentally ill family members is estimated by Franks (1987) in a study conducted for the National Institute of Mental Health. Included is time spent in the following activities: caregiving; work loss; time with lawyers, clergy, professionals; recreation; and other. Franks estimates a total value of time spent by caregivers at \$2.5 billion based on a survey of the membership of the Massachusetts Alliance for the Mentally Ill, a family support and advocacy group.

SUMMARY

Other related direct and indirect costs are estimated at \$47.5 billion for 1985. Of this total, \$22.3 billion (47 percent) is for direct costs and the remaining \$25.2 billion (53 percent) is for indirect costs. Drug abuse costs comprise the largest share of the total other related costs -- \$32.5 billion or 68 percent. Alcohol abuse costs are \$10.5 billion (22 percent), and mental illness costs amount to \$4.5 billion (9 percent).

CHAPTER VII

SPECIAL DISEASE GROUPS

AIDS AND DRUG ABUSE

The emergence of the acquired immunodeficiency syndrome (AIDS) epidemic has focused attention on the economic impact of this dread disease. Three studies document the direct and indirect costs of human immunodeficiency virus (HIV) diseases in the United States:

- 1) Hardy and associates (1986) estimate lifetime hospital costs of the first 10,000 patients with AIDS reported in the United States at \$1.5 billion, or \$147,000 per AIDS patient, and indirect costs amounting to \$4.6 billion.
- 2) Scitovsky and Rice (1987) estimate the direct costs (medical and nonmedical costs) of AIDS as follows: \$1.0 billion for 1985, \$1.7 billion for 1986, and \$10.9 billion for 1991. Indirect costs amount to \$3.9 billion for 1985, \$7.0 billion for 1986, and \$55.6 billion for 1991.
- 3) Bloom and Carliner (1988) estimate that the total cumulative direct and indirect costs of all AIDS cases for the 1981-1991 period might reach \$22 billion.

Other studies estimate the direct personal medical care costs of AIDS:

- 1) Andrulis and associates (1987) estimate that inpatient hospital costs associated with all diagnosed AIDS cases exceed \$380 million for 1985.
- 2) Green and associates (1987) project U.S. hospital costs attributable to AIDS cases to approximately \$3.5 billion for 1991.
- 3) Hellinger (1988) forecasts the direct personal medical care costs of AIDS to be \$2.2 billion for 1988, increasing to \$4.5 billion for 1991.
- 4) Scitovsky and associates (1986) estimate lifetime direct costs at \$27,571 per case for 1984 based on data for patients who received lifetime AIDS inpatient care from San Francisco General Hospital.
- 5) Sisk (1987) reviews the available evidence from a variety of studies of the cost of AIDS and AIDS-related complex in the United States. AIDS incidence-based lifetime direct cost estimates range from \$24,517 to \$147,000 per case.
- 6) In two recent articles, Scitovsky (1988; 1989) also reviews the studies and estimates relating to the costs of AIDS and its economic impact. In the 1988 article, she emphasizes the serious financial impact of AIDS on hospitals, especially public hospitals in urban areas. In the 1989 article, the major economic aspects of HIV-

related illnesses are emphasized including financing the care of HIV-infected persons.

7) Hellinger (1990) projects the number and medical care costs of AIDS cases to 1993. Lifetime medical care costs are estimated at about \$75,000, reflecting recent increases in the length of survival and diffusion of costly drug therapies, such as azidothymidine (AZT) and aerosol pentamidine

None of the above studies provides estimates of the direct and indirect costs of the AIDS virus among people who inject drugs intravenously. A variety of estimates are available on the HIV infection rate. For example, it is estimated that half of the people who inject drugs in New York City are infected with the HIV virus. Intravenous (IV) drug addicts accounted for 53 percent of all AIDS deaths between 1978 and 1986 in New York City (Booth, 1988).

As of November 14, 1988, the Centers for Disease Control (CDC) reported that of the 78,312 cumulative number of AIDS cases, 20 percent were IV drug users, but the proportion of IV drug users among women was three times that for men -- 52 percent compared to 17 percent.

In 1985, the reference year of this study, IV drug users represented 20 percent of the total cases. The direct and indirect cost of AIDS in 1985 for IV drug users is estimated at 20 percent of the total cost of AIDS costs developed by Scitovsky and Rice (1987) as shown below.

<u>Type of Cost</u>	<u>Total</u> (millions)	<u>IV Drug Users</u> (millions)
Total	\$4,836	\$967
Direct	949	190
Personal Medical	630	126
Nonpersonal	319	64
Indirect	3,887	777
Morbidity	261	52
Mortality*	3,626	725

* 4 percent discount rate.

FETAL ALCOHOL SYNDROME

Fetal Alcohol Syndrome (FAS) is a distinct pattern of physical and mental abnormalities occurring in children born of alcoholic women who drink heavily during pregnancy. First described in the literature in the early 1970s, FAS is now recognized as a serious disorder with physical and mental deficiencies costly to treat, difficult to rehabilitate, and requiring special long-term services.

Estimates of the incidence of FAS are difficult to ascertain and vary from 1 in 200 to 1 in 1,000 live births (Harwood et al., 1984). The difficulty in establishing accurate incidence and prevalence rates is due to several factors. Facial features and mental deficiencies associated with the syndrome are not

easy to recognize at birth and may not be identified for several years. The study site is also a major determinant. Abel and Sokol (1987) indicate in their survey of the literature that estimated incidence rates at sites where a majority of the mothers were low-income blacks or Indians were 2.6 per 1,000 live births compared to 0.6 per 1,000 live births at sites where mothers were middle-income whites.

Estimates also vary depending on whether studies were conducted retrospectively or prospectively. Retrospective incidence rates are estimated by determining the proportion of births where FAS has already been diagnosed and extrapolating to the total newborn population. Prospective rates are estimated by determining the incidence of FAS among alcohol abusing women in combination with estimates of alcohol abuse during pregnancy. Abel and Sokol report that incidence estimates average 2.9 per 1,000 live births for retrospective studies and 1.1 per 1,000 live births for prospective studies. Out of a total number of 88,236 births, their review identifies 164 cases of FAS, giving an incidence rate of 1.9 cases per 1,000 births. Using this incidence rate, they estimate the number of children born in 1984 with FAS at 7,024.

Specific birth defects that occur as part of the fetal alcohol syndrome include prenatal and postnatal growth retardation (low birthweight) requiring neonatal intensive care; auditory problems such as otitis media and hearing loss; mental impairment ranging from minimal brain dysfunction to severe mental retardation; and anatomical abnormalities, such as heart valve defects and cleft palate, requiring surgical correction. Abel and Sokol estimate the annual treatment costs for these specific defects. The results are shown in Table 65.

The total annual costs equal \$1.6 billion. The largest proportion of funds, \$1.3 billion (80 percent) is for residential care and support services for mentally retarded persons over age 21, whose impairment is assumed to be caused by FAS. Neonatal intensive care costs of treating growth retardation are \$118 million (7 percent), and for full-time residential care for severely mentally retarded persons under age 21, \$110 million (7 percent). The emergence in recent years of crack cocaine users and the resulting burden of care for their children are not covered in this study but will obviously add to ADM costs.

HOMELESS POPULATION

The costs of medical care and related services for the homeless population suffering from ADM illnesses are important and legitimate costs to society. The quantification of such costs, however, cannot be made because of the paucity and unreliability of available data on the prevalence of homelessness and the extent of ADM illnesses among this group. A review of the literature reveals that the issue of homelessness is identified with multiple factors that are complex, interrelated, and highly variable geographically and seasonally. There are problems with defining the homeless as a group and with obtaining reliable national estimates of their numbers. Recent studies have been local in scope and reflect varying methodologies, making extrapolations to the national population of questionable reliability.

Table 65

ESTIMATED COST OF FETAL ALCOHOL SYNDROME, 1985

<u>Category</u>	<u>Amount (millions)</u>	<u>Percent Distribution</u>
Total	\$1,611	100.0
Growth Retardation (intensive care costs)	118	7.3
Growth retardation at birth	91	5.6
Rehospitalization of low birthweight infants	26	1.6
Single year morbidity	1	0.06
Abnormalities Requiring Surgical Correction	17	1.1
Cleft palate	15	0.9
Heart defects	2	0.1
Auditory defects	0.2	0.01
Full-Time Residential Care (for severely retarded)	110	6.8
Semi-Independent Supervised Care (for moderately retarded)	76	4.7
Residential Care for Adults Over Age 21	1,287	79.9
Research	3	0.2

SOURCE: Adapted from Abel and Sokol, 1987, Tables 4, 5 and 6.

Definition of Homelessness

For the purposes of this study, the definition of "homelessness" or "homeless individual" is the same as that used by the Institute of Medicine (1988) and the U.S. General Accounting Office (GAO) (1988b). In these reports, a homeless person is defined as "an individual who lacks a fixed, regular, and adequate night-time residence and who has a primary night-time residence that is:

- 1) A supervised or publicly operated shelter designed to provide temporary living accommodations (including welfare hotels, congregate shelters, and transitional housing for the mentally ill);
- 2) An institution that provides a temporary residence for individuals intended to be institutionalized; or
- 3) A public or private place not designed for regular sleeping accommodation for human beings (P.L. 100-77, sec. 103(a), the Stewart B. McKinney Homeless Assistance Act, July 1987).

Homelessness has also come to mean more than merely the lack of adequate shelter. Homeless people are usually multiply disadvantaged and lack not only shelter, but food, clothing, medical services, and social support systems (Bachrach, 1985).

Who Are the Homeless?

The homeless as a group represent a heterogeneous population. Historically, they were viewed primarily as alcoholics, drug addicts, and/or transients and generally were described as white, elderly males. More recently, service providers have reported that the homeless are comprised of other sub-groups, including the mentally ill, persons who have lost their jobs or public assistance, younger people in their mid-thirties, and women and children (U.S. GAO, 1985; Bricker et al., 1984).

It is difficult to determine the extent of the homeless population for several reasons. The population changes continuously as transients move on and people gain employment or become unemployed. A significant portion of the homeless occupy unconventional places that are difficult to locate, such as abandoned buildings, dead-end alleys, parking garages, and bus or train yards. In addition, the majority of studies have been conducted in community emergency shelters and have excluded a significant group who remain outside the shelters sleeping on the street, in bus terminals, or on park benches. According to the Community for Creative Non-Violence (CCNV), an advocacy group and shelter provider based in Washington, DC, accurate counts of homeless persons are difficult to obtain because "many spend a great deal of time and energy trying to remain invisible in order to carry out their activities of daily living and to escape threats, violence, and harassment from others who can see their vulnerability" (U.S. GAO, 1985, p. 7).

Several efforts have been made in recent years to obtain a national estimate of the homeless population (see Table 66). The results vary greatly, ranging from a low of 192,000 to a high of 2.2 million (Institute of Medicine,

Table 66

NATIONAL ESTIMATES OF THE HOMELESS POPULATION

Source	Estimate	Assumptions Used
Hombs and Snyder (1982)	2,200,000	Based on a small number of high local estimates. Apparently uses city populations to estimate a rate of homelessness. Applies constant rate of homelessness to the entire country.
U.S. Department of Housing and Urban Development (1984)		
1.	192,000	Applies a street-to-shelter ratio to estimates of the sheltered population.
2.	254,000	Based on estimates for 60 cities. Uses metropolitan population as the base. Calculates rates separately for large, medium, and small areas.
3.	586,000	Takes highest local estimates. Uses metropolitan population as the base. Assumes a constant rate of homelessness nationwide.
Tucker (1987)	700,000	Based on estimates for 50 cities. Uses city populations as the base. Allows rates to vary for large, medium, and small cities.
Freeman and Hall (1986)	287,000	Applies a street-to-shelter ratio to estimates of the sheltered population.
Alliance Housing Council (1988)	735,000 on a given night; 1.3 million to 2.0 million during 1988	Based on reinterpretation and extrapolation from U.S. Dept. of Housing and Urban Development (1984) studies. Assumes suburban rate of 1/3rd the city rate. Assumes 20% growth in homelessness each year.

SOURCE: Institute of Medicine, 1988.

1988). On any night, about 68,000 children and youths aged 16 and younger may be members of homeless families (U.S. GAO, 1989). There is consistent agreement among researchers that the size of the homeless population is growing. However, because of the absence of baseline data, no one has been able to document the increase, which varies from a HUD estimate of 10 percent per year between 1980 and 1983 to a U.S. Conference of Mayors estimate of 38 percent during 1983 (U.S. GAO, 1985). Multiple factors contribute to the increase in homelessness. These include a lack of community-based mental health services combined with increases in unemployment; a decline in the supply of low-income housing; cuts in public assistance programs; increases in personal crises such as divorce, domestic violence, and alcohol and drug abuse problems; and the deinstitutionalization of mentally ill persons (Barbieri and Fricke, 1989).

Incidence of Alcohol and Drug Abuse and Mental Illness

Alcohol and drug abuse and mental illness are major health problems among the homeless population. Several studies report that the average rate of alcohol abuse is 38 percent, ranging from 21 to 67 percent (Wright and Knight, 1987). The U.S. GAO (1988b) indicates that the proportions of homeless persons identified as mentally ill ranges from one-fifth to one-third when judgments of service providers are used to determine mental illness; when standardized instruments are applied, these rates range from one-sixth to nearly half.

These figures are supported by data collected from the National Health Care for the Homeless Program, based on 30,000 homeless clients seen between March 1985 and June 1986 in 16 cities across the United States. Wright and Knight (1987) report that the incidence of alcohol and drug abuse and mental illness is directly related to the number of client contacts, as shown in Table 67. The more times a client is seen, the more likely the client is to be diagnosed with an ADM problem. Table 67 shows that of 11,859 clients who were seen once, 17.1 percent were diagnosed with an alcohol problem, 5.2 percent with a drug problem, and 11.2 percent with a mental problem. Over the same cities and time span, 3,771 clients were seen five or more times. Among this group, 37 percent were diagnosed with an alcohol problem, 13.5 percent were identified as drug abusers, and 43.1 percent were found to have significant psychiatric impairment.

In their study of 529 homeless adults, Gelberg, Linn, and Leake (1988) report 29 percent with a previous hospitalization for a mental, emotional or nervous problem, 22 percent for an alcohol problem, and 14 percent for a drug problem. They divide their sample into three groups as shown in Table 68. A total of 232 (44 percent) reported being hospitalized for a mental, emotional, alcohol or drug problem, 81 (15 percent) report a previous outpatient visit for these disorders, and 216 (41 percent) reported they had never used mental health services. The hospitalization group was three times more likely than the non-utilizer group to drink alcohol on a daily basis, and was five times more likely to have had delirium tremens. Although the outpatient and non-utilizer groups had a lower prevalence of alcohol and illegal drug use, at least 41 percent had used illegal drugs during the previous month.

Data are not available on the time spent by homeless alcoholics and mentally ill persons in public and private institutions and hospitals. A report prepared by Neuner and Schultz for the Minnesota Department of Health (Parker et al., 1985) provides data on the utilization of such agencies by chronic alcoholics. The services used by one chronic alcoholic total 317 days during one

Table 67

OBSERVED INCIDENCE OF SELECTED DISORDERS
AS A FUNCTION OF THE NUMBER OF CLIENT CONTACTS
(Adults only, n=16 Cities)

	<u>Number of Client Contacts</u>				
	<u>One</u>	<u>Two</u>	<u>Three</u>	<u>Four</u>	<u>Five+</u>
Number of clients	11,859	4,438	2,294	1,383	3,771
<u>Percentage Diagnosed with:</u>					
Alcohol Problem	17.1	21.9	26.2	30.0	37.0
Drug Problem	5.2	7.8	9.6	9.1	13.5
Mental Problem	11.2	17.3	23.5	24.2	43.1
Hypertension	6.6	9.9	12.3	15.0	20.2
Diabetes	1.2	1.5	1.6	2.7	3.9

SOURCE: Wright and Knight, 1987.

Table 68

USE OF ALCOHOL AND DRUGS AMONG 529 HOMELESS ADULTS,
GROUPED ACCORDING TO PREVIOUS USE OF MENTAL HEALTH SERVICES

Measure	Total n=529		Hospitalization Group n=232		Outpatient Group n=81		Nonutilizer Group n=216	
	Number %		Number %		Number %		Number %	
	Number	%	Number	%	Number	%	Number	%
Used alcohol in past month	362	68	182	78	46	57	134	62
Frequency of alcohol use								
Every day	105	20	72	31	10	12	23	11
1-6 times a week	188	36	75	32	31	38	82	38
Less than once a week	130	25	54	23	21	26	55	25
None in past year	84	16	22	9	18	22	44	20
Delirium tremens (lifetime)	94	18	69	30	11	14	14	6
Used illegal drugs in past month	262	50	135	58	38	47	89	41

SOURCE: Adapted from Gelberg, Linn, and Leake, 1988, p. 194.

year. The authors conclude that, based on an estimated population size of 425 active chronic alcoholic clients, the estimated total annual cost in Minnesota exceeds \$22,800 per client, or \$9.7 million per year.

Kline, Bacon, Chinkin, and Manov (1987) developed a computerized Alcohol Client Tracking System (ACTS), which provides data on homeless client utilization of alcohol treatment services in Los Angeles County. Planners and administrators can monitor client use of services, service costs, patterns of movement through the system, and service outcomes. A study of admission patterns for one year confirms the belief that some of the homeless with alcohol problems use admission to relatively expensive detoxification programs as a way of obtaining room and board. These data were used to obtain county support for less expensive alcohol-free living centers (AFLCs), which more closely meet the needs of some of the recurring participants in detoxification programs. Automation of client tracking records through ACTS and similar data processing systems offers new capability for measuring program effectiveness and improving resources.

Discussion

Homelessness has long been recognized as a serious and growing social problem. However, scientifically acceptable methods for estimating the size and composition of this group are lacking.

Rossi, Wright, Fisher, and Willis (1987) discuss several factors they believe are major determinants of the size of the population at risk for homelessness. These factors include 1) the ability of poverty-level families to accommodate their disabled or unemployed members, 2) the numbers of disabled and unemployed, 3) real dollar decreases in the level of income maintenance support for poor families, 4) changes in the coverage of income maintenance and other support programs, 5) quantitative and qualitative changes in the supply of low-cost housing, 6) changes in the demand for low-skill workers, and 7) direct changes in the numbers of deinstitutionalized mentally ill and abusers of drugs and alcohol.

Additional research is needed to examine the interrelatedness of these factors and measure the degree to which they influence the numbers of homeless people. Such data would be extremely valuable in helping to determine the costs of ADM illnesses within the homeless population.

CHAPTER VIII

COST ESTIMATES FOR 1988

The impact of alcohol abuse, drug abuse, and mental illness (ADM) on society is enormous in terms of the economic cost, the public and private burden of the cost, and the devastating effect on the lives of individuals suffering from ADM disorders and their families. This report estimates the economic burden of ADM disorders for 1985, the latest year for which reliable data are available. Data for more recent years would be useful for making program policy decisions, preparing and delivering testimony, and supporting agency budgets. However, many surveys and other data sources on which the economic costs are based are conducted periodically, rather than annually. Therefore, the approach taken herein to updating the economic costs is to employ a limited number of economic data and indexes with known relationships to ADM cost estimates. Although there is some imprecision in this approach, the aggregate data can be useful for policy purposes.

The 1985 economic cost estimates are projected to 1988 below and the method, data, and sources used for making these projections are described. In future years, cost estimates employing these data can be maintained on a current basis. The Research Triangle Institute (RTI) updated their 1980 cost estimates to 1983 using this general approach (Harwood et al., 1984). Some refinements in the data sources are made in the present study.

ADJUSTMENT FACTORS

A variety of factors affect the changes between 1985 and 1988 in the economic costs of ADM. As noted by RTI (Harwood et al., 1984, p. G-4), the following factors are significant in making cost estimates:

- 1) Inflation in wages and prices;
- 2) Growth of the population at risk;
- 3) Sociodemographic distribution;
- 4) Change in the prevalence or incidence rates;
- 5) Causal factors; and
- 6) Social responses to ADM.

Although all of these factors contribute to changes in costs, only the first two are used to project costs. Table 69 lists the cost components for ADM estimation and specifies adjustment factors to reflect inflation and real change (e.g., change in medical care use, morbidity, mortality). The data series listed on the table are updated annually and are readily available and published by the federal government. Table 70 shows the annual data for 1985 through 1988 for each adjustment factor.

Table 69

ADJUSTMENT FACTORS FOR UPDATING ADM ECONOMIC COST ESTIMATES

Cost Component	Adjustment Factor	Data Series	Source
Core Costs			
Direct Costs			
Treatment	Inflation & Real Change	National Health Expenditures (NHE)	Health Care Financing Review (HCFR)
Short-Stay Hospital		Hospital care	
ADM Specialty Institution		Hospital care	
Office-Based Physicians		Physicians' services	
Other Professional Services		Other professional services	
Nursing Homes		Nursing home care	
Drugs		Drugs and medical sundries	
Support			
Research	Inflation & Real Change	NHE for research	HCFR
Training	Inflation	CPI-personal and educ. expense	Monthly Labor Review
	Real Change	Number of active M.D.s	Statistical Abstracts
Health Ins. Admin.	Inflation & Real Change	NHE for program admin. and net cost of insurance	HCFR
Indirect Costs			
Morbidity	Inflation	Compensation per hour, bus. sector	Employmt. & Earnings
	Real Change	U.S. Civilian Labor Force	Monthly Labor Review
Mortality	Inflation	Compensation per hour, bus. sector	Employmt. & Earnings
	Real Change	Total deaths	Monthly Vital Statist.
Other Related Costs			
Direct Costs			
Crime	Inflation	GNP Implicit Price Deflator: Government purchases of goods and services	Survey of Current Business
	Real Change	Number of arrests	Crime in the U.S.
Other Direct Expenditures			
Motor Vehicle Crashes	Inflation	GNP Implicit Price Deflator	Surv. Current Business
	Real Change	Motor Vehicle Accidents	Accident Facts
Fire Destruction	Inflation & Real Change	Fire losses	Insurance Facts
Social Welf. Admin.	Inflation & Real Change	Social welfare expenditures	Social Security Bull.
Indirect Costs	Inflation	Compensation per hour, bus. sector	Employmt. & Earnings
	Real change	Number of arrests	Crime in the U.S.
Special Disease Groups			
AIDS	Inflation	CPI - Medical Care	Monthly Labor Review
	Real Change	AIDS cases diagnosed	CDC HIV/AIDS Surveill.
Fetal Alcohol Syndrome	Inflation	CPI - Housing	Monthly Labor Review
	Real Change	Number of births	Monthly Vital Statist.

DATA FOR ADJUSTMENT FACTORS FOR UPDATING ADM
ECONOMIC COST ESTIMATES, 1985 - 1988

<u>Adjustment Factor</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Health Expenditures (billions)				
Hospital Care	\$166.7	\$178.4	\$194.7	\$211.4
Physicians' Services	81.4	91.6	102.7	116.0
Other Professional Services	12.4	14.1	16.2	18.3
Nursing Home Care	34.7	37.4	40.6	44.9
Drugs and Medical Sundries	28.5	31.3	34.0	36.9
Research	7.5	8.3	8.8	9.8
Program Administration and Net Cost of Insurance	22.6	23.9	25.9	27.0
Consumer Price Index - Personal and Educational Expense	119.1	128.6	138.5	147.9
Consumer Price Index - Medical Care	113.6	122.0	130.2	139.0
Consumer Price Index - Housing	106.6	109.7	112.8	116.2
Number of Active M.D.s (000s)	511.0	519.4	534.7	550*
Compensation per Hour, Bus. Sector (index)	175.5	183.8	191.0	200.4
U.S. Civilian Labor Force (millions)	115.5	117.8	119.9	121.7
Total Births (000s)	3,761	3,757	3,829	3,914
Total Deaths (000s)	2,086	2,105	2,127	2,171
GNP Price Deflator for Government Purchases of Goods and Services (index)	112.3	114.5	118.5	123.4
Number of Arrests (000s)	11,945	12,488	12,712	13,812
Number of AIDS Cases Diagnosed	10,794	17,452	25,457	29,023
Motor Vehicle Accidents (millions)	19.3	17.7	20.8	24.4*
Fire Losses (millions)	\$7,753	\$8,488	\$8,504	\$8,634*
Social Welfare Expenditures (billions)	\$737.2	\$782.8	\$834.4	\$889.4*

* 1988 data not available; estimated by applying 1986 to 1987 percentage change to 1987 numbers.

NOTE: 1988 Health Expenditures are not available from the Health Care Financing Administration (HCFA); U.S. Dept. of Commerce, 1990 published estimates for 1988, which were adjusted by applying 1987 to 1988 percentage change shown in this report to the 1987 expenditures reported by HCFA.

Table 71

PERCENT CHANGE IN ADM ECONOMIC COSTS BY TYPE OF COST,
1985 - 1988

<u>Type of Cost</u>	<u>Amount (millions)</u>		<u>Percent Change</u>
	<u>1985</u>	<u>1988</u>	
Total	\$218,081	\$273,333	25.3
Core Costs	167,993	206,506	22.9
Direct	51,420	66,774	30.6
Treatment	47,485	61,956	30.5
Support	3,935	4,818	22.4
Indirect	116,573	139,732	19.9
Morbidity	80,762	97,173	20.3
Mortality	35,811	42,559	18.8
Other Related Costs	47,510	61,809	30.1
Direct	22,267	28,479	27.9
Indirect	25,243	33,330	32.0
Special Disease Groups	2,578	5,018	94.6
AIDS	967	3,181	229.0
Fetal Alcohol Syndrome	1,611	1,837	14.0

Several data sources incorporate both inflation and real change. For example, National Health Expenditures (NHE) data, produced annually by the Health Care Financing Administration (HCFA), are used to project treatment costs. Expenditures by type of service are used for the relevant ADM cost components. The NHE incorporates inflation in the medical care market as well as population change. Thus, the percentage change from 1985 to 1988 in hospital care expenditures is applied to ADM short-stay hospital costs and to ADM specialty institutions. For morbidity costs, inflation and real change are estimated separately. The change in compensation per hour in the business sector is used for inflation, and the change in the U.S. civilian labor force is used to reflect real change.

The 1988 health expenditures are not available from HCFA at the time of the writing of this report. However, *U.S. Industrial Outlook 1990* (U.S. Dept. of Commerce, 1990) produces estimates of health expenditures for 1987 and 1988 that are slightly different from the 1987 HCFA estimates. The 1988 health expenditures shown in Table 70 are estimated by applying the 1987-1988 percentage change shown in *U.S. Industrial Outlook 1990* to the 1987 expenditures reported by HCFA.

For three adjustment factors (number of active M.D.s, motor vehicle accidents, and social welfare expenditures), 1988 data are not yet available. Estimates for 1988 are made by applying the 1986 to 1987 percentage change to the 1987 numbers.

FINDINGS

The total economic cost of ADM in 1988 is estimated at \$273.3 billion (Table 6), distributed as follows:

	<u>Amount (billions)</u>	<u>Percent of Total</u>
Alcohol Abuse	\$85.8	31.4%
Drug Abuse	58.3	21.3
Mental Illness	129.3	47.3

During the three-year period, 1985 to 1988, the total economic costs of ADM increased 25 percent. There is substantial variation in the percent changes by type of cost. Direct costs rose 30.6 percent; indirect costs increased 19.9 percent; and other related costs increased 30.1 percent (Table 71). The larger increase in direct costs reflects the rapid rise of medical care prices during this period compared to a much lower rate of increase in earnings. The large increase in other related costs reflects increases in the number of arrests, motor vehicle accidents, and fire losses. The recent rise in the use of crack cocaine and the resulting increase in medical care utilization and in crime is not adequately reflected in these projections. By far the largest increase from 1985 to 1988, 229 percent, is for the cost associated with acquired immunodeficiency syndrome (AIDS) among intravenous (IV) drug users, reflecting the rise in the number of AIDS cases during this period.

CHAPTER IX

COMPARISON WITH PREVIOUS COST ESTIMATES

One of the objectives of this study is to update the 1980 estimates made by the Research Triangle Institute (RTI) (Harwood et al., 1984) of the economic costs of ADM disorders. This chapter compares the cost estimates of the present study conducted at the University of California, San Francisco (UCSF) with those of RTI, highlighting the main sources and reasons for the differences.

An update of costs from 1980 to 1985 would be expected to encompass a rise due to inflation and to reflect any changes in the prevalence of ADM diseases. With no change in prevalence or in estimating methodology, direct medical care expenditures for ADM disorders might be expected to increase about 72 percent, the rise in national health expenditures during this period (U.S. HCFA, 1987). In fact, direct ADM expenditures are 45 percent higher in 1985 and the total, including indirect and other related costs, is only 14 percent higher. Tables 72 through 75 compare the costs for the two years for total ADM and for each disorder. After a brief presentation of the differences by type of costs, the remainder of the present chapter discusses the main reasons for the changes for selected components of costs.

TOTAL ECONOMIC COSTS

The UCSF 1985 estimates for total ADM economic costs are 14 percent higher than the RTI estimates for 1980, \$218 billion compared to \$191 billion, respectively. Core costs are 4 percent higher, while other related costs are 63 percent higher. The distribution of total costs by type of cost changed between the two years, as shown in Figure 24. Morbidity costs as a percentage of total costs declined from 54 percent to 37 percent, with a 4 percent increase in mortality costs, and an 8 percent increase in other related costs. The distributions by type of cost for 1985 shown in Tables 58-61 are slightly different from those shown in Figures 24-27 because the cost estimates for the special disease groups are combined with other related costs in the figures only.

Costs of Alcohol Abuse

The UCSF 1985 estimates for alcohol abuse are 21 percent lower than the RTI estimates for 1980, \$70 billion compared to \$90 billion, respectively. Almost all of the categories of expenditures are lower, except mortality costs and indirect other related costs, which are 66 percent and 30 percent higher, respectively. The comparison of the distribution by type of costs shows that morbidity costs as a percentage of total costs declined from 61 percent in 1980 to 39 percent in 1985, while the mortality cost share rose from 16 percent to 34 percent (Figure 25).

Costs of Drug Abuse

The total costs of drug abuse estimated by UCSF and by RTI remained almost the same, \$44.1 billion in 1985, compared with \$46.9 billion in 1980. There are significant differences, however, by type of cost, ranging from 75 percent less for morbidity costs to 105 percent higher for other related direct costs. The reasons for the lower estimates are mainly methodological, involving the use of

Table 72

ECONOMIC COSTS OF ADM BY TYPE OF COST, 1980 AND 1985

<u>Type of Cost</u>	<u>1980</u>		<u>1985</u>		<u>Percent Change</u>
	<u>Amount (millions)</u>	<u>Percent Distribution</u>	<u>Amount (millions)</u>	<u>Percent Distribution</u>	
Total	\$190,698	100.0	\$218,081	100.0	14.4
Core Costs	161,476	84.7	167,993	77.0	4.0
Direct	35,470	18.6	51,420	23.6	45.0
Treatment	31,647	16.6	47,485	21.8	50.0
Support	3,823	2.0	3,935	1.8	2.9
Indirect	126,004	66.1	116,573	53.4	9.3
Morbidity	102,372	53.7	80,762	37.0	-21.1
Mortality	23,632	12.4	35,811	16.4	51.5
Other Related Costs	29,222	15.3	47,510	21.8	62.6
Direct	15,661	8.2	22,267	10.2	42.2
Indirect	13,562	7.1	25,243	11.6	86.1
Special Disease Groups	-	-	2,578	1.2	-

Table 73

ECONOMIC COSTS OF ALCOHOL ABUSE BY TYPE OF COST, 1980 AND 1985

Type of Cost	1980		1985		Percent Change
	Amount (millions)	Percent Distribution	Amount (millions)	Percent Distribution	
Total	\$89,526	100.0	\$70,338	100.0	-21.4
Core Costs	79,607	88.9	58,181	82.7	-26.9
Direct	10,471	11.7	6,810	9.7	-35.0
Treatment	9,487	10.6	6,315	9.0	-33.4
Support	984	1.1	461	0.7	-53.2
Indirect	69,136	77.2	51,371	73.0	-25.7
Morbidity	54,680	61.1	27,388	38.9	-49.9
Mortality	14,456	16.1	23,983	34.1	65.9
Other Related Costs	9,919	11.1	10,546	15.0	6.3
Direct	7,482	8.4	7,380	10.5	-1.4
Indirect	2,437	2.7	3,166	4.5	29.9
Special Disease Groups	-	-	1,611	2.0	-

Table 74

ECONOMIC COSTS OF DRUG ABUSE BY TYPE OF COST, 1980 AND 1985

Type of Cost	1980		1985		Percent Change
	Amount (Millions)	Percent Distribution	Amount (Millions)	Percent Distribution	
Total	\$46,936	100.0	\$44,052	100.0	-6.1
Core Costs	29,451	62.7	10,624	24.1	-63.9
Direct	1,443	3.1	2,082	4.7	44.3
Treatment	1,200	2.6	1,881	4.3	56.8
Support	243	.5	201	0.4	-17.3
Indirect	28,008	59.7	8,542	19.4	-69.5
Morbidity	26,028	55.5	5,979	13.6	-77.0
Mortality	1,980	4.2	2,563	5.8	29.4
Other Related Costs	17,485	37.3	32,461	73.7	85.7
Direct	6,449	13.8	13,209	30.0	104.8
Indirect	11,036	23.5	19,252	43.7	74.4
Special Disease Groups	-	-	967	2.2	-

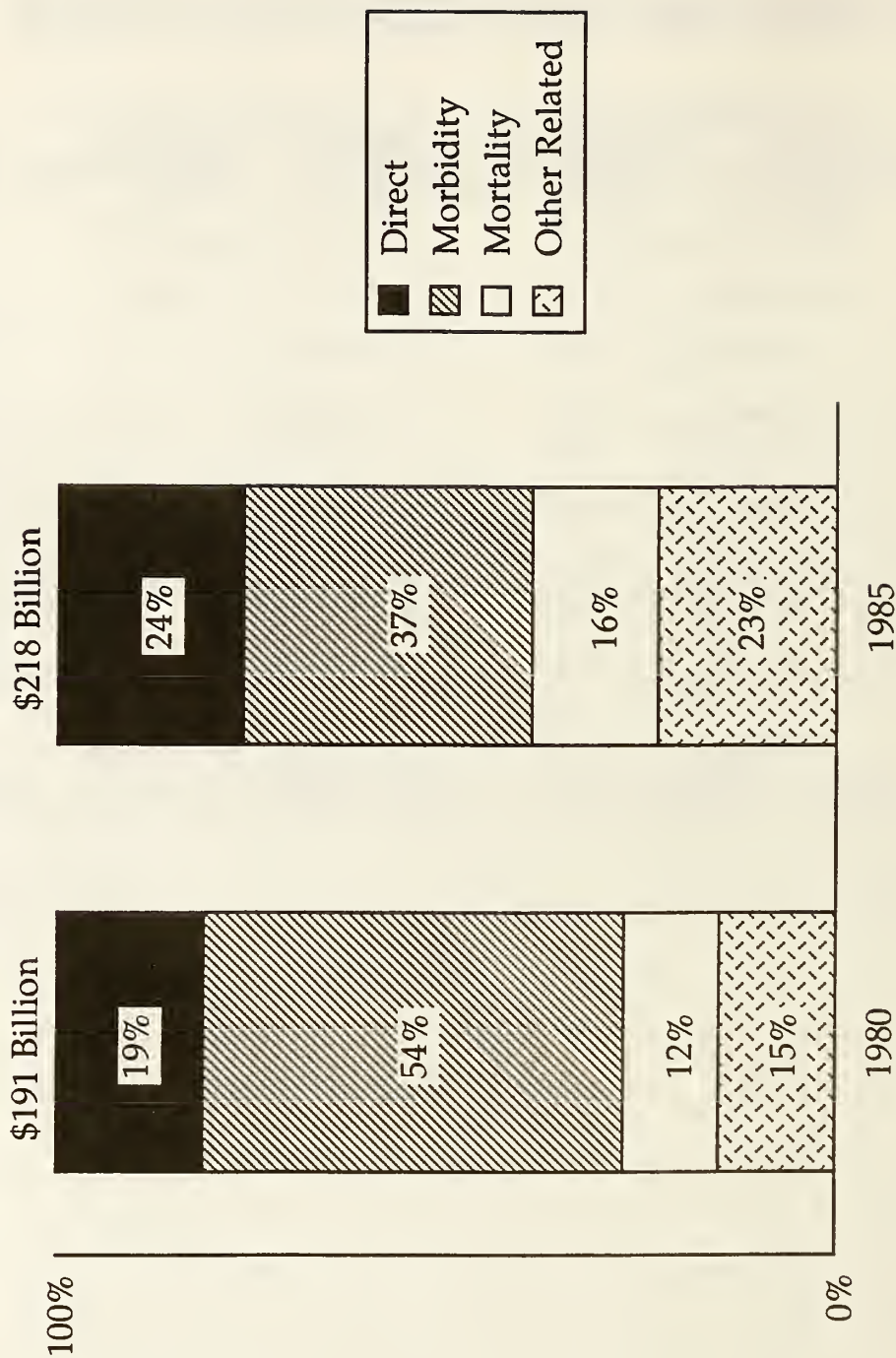
Table 75

ECONOMIC COSTS OF MENTAL ILLNESS BY TYPE OF COST, 1980 AND 1985

Type of Cost	1980		1985		Percent Change
	Amount (Millions)	Percent Distribution	Amount (Millions)	Percent Distribution	
Total	\$54,236	100.0	\$103,691	100.0	91.2
Core Costs	52,418	96.6	99,188	96.0	89.2
Direct	23,558	43.4	42,528	33.6	80.5
Treatment	20,961	38.6	39,289	31.0	87.4
Support	2,597	4.8	3,239	2.7	16.0
Indirect	28,860	53.2	56,660	62.4	124.7
Morbidity	21,664	39.9	47,395	54.3	118.8
Mortality	7,196	13.3	9,265	8.1	28.8
Other Related Costs	1,818	3.4	4,503	4.0	147.7
Direct	1,730	3.2	1,678	1.5	3.0
Indirect	88	.2	2,825	2.5	3,110.2

Figure 24

Distribution of Economic Costs of ADM by Type of Cost, 1980 and 1985



new data sources; these are discussed below. The distribution of costs shows considerable change between the two years. Morbidity costs as a percentage of total costs declined from 56 percent in 1980 to 14 percent in 1985, and other related costs increased from 37 percent to 76 percent of the total (Figure 26).

Costs of Mental Illness

The total costs of mental illness almost doubled, \$54.2 billion in 1980 compared to \$103.7 billion in 1985. The largest percentage change occurred in the other related indirect costs, estimated at \$88 million in 1980 and \$2.8 billion in 1985. The reason for this large change is the addition in 1985 of a new cost category -- the value of time lost by caregivers for care provided to mentally ill family members. The largest dollar change between the two years is for morbidity costs, estimated at \$21.7 billion in 1980 and \$47.4 billion in 1985. The reasons for the very large change are methodological differences and the availability of a new data set on which to base the estimates.

The distribution of costs of mental illness also changed slightly between the two years. Direct costs as a percentage of total costs declined from 44 percent in 1980 to 41 percent in 1985, and morbidity costs increased from 40 percent to 46 percent (Figure 27).

DIRECT CORE COSTS

Table 76 compares the ADM direct core costs for 1980 and 1985. Although the total is 48 percent higher in 1985, the changes among the cost categories range from 17 percent less for office-based physicians and 11 percent less for drugs, to 282 percent higher for nursing home costs. These differences are mainly due to the use of new sources of data and different methods for estimating costs described in detail below for selected cost categories.

Estimates for two cost categories, other health services and volunteer services, were not made in 1985. These costs totaled \$1.1 billion in 1980. Other health services, as defined in the National Health Accounts (U.S. HCFA, 1987), include industrial in-plant health services, school health services, and the provision of care in federal units other than hospitals. RTI estimated the costs for these services by subtracting from the total expenditures for other health services the expenditures for ADM facilities and services. This figure was multiplied by a ratio of costs for treatment of ADM to the costs of treatment for all illnesses. This methodology did not appear to be appropriate for the current study, nor is there an adequate database with which to estimate these costs. We therefore omitted them from our estimates. We also did not estimate the value of volunteer services, amounting to \$295 million in 1980, because of a lack of data on which to base the estimates.

The main sources of difference between the two sets of estimates for most of the cost categories included in the direct core costs are the use in the current study of a direct method of estimation based on new and current surveys. RTI employed an indirect cost estimation methodology that involved estimation of ADM utilization of specific medical care services as a percentage of total use and application of these proportions to the total expenditures reported in the National Health Accounts for each cost category. Following is a detailed

Figure 25

Distribution of Economic Costs of Alcohol Abuse by Type of Cost, 1980 and 1985

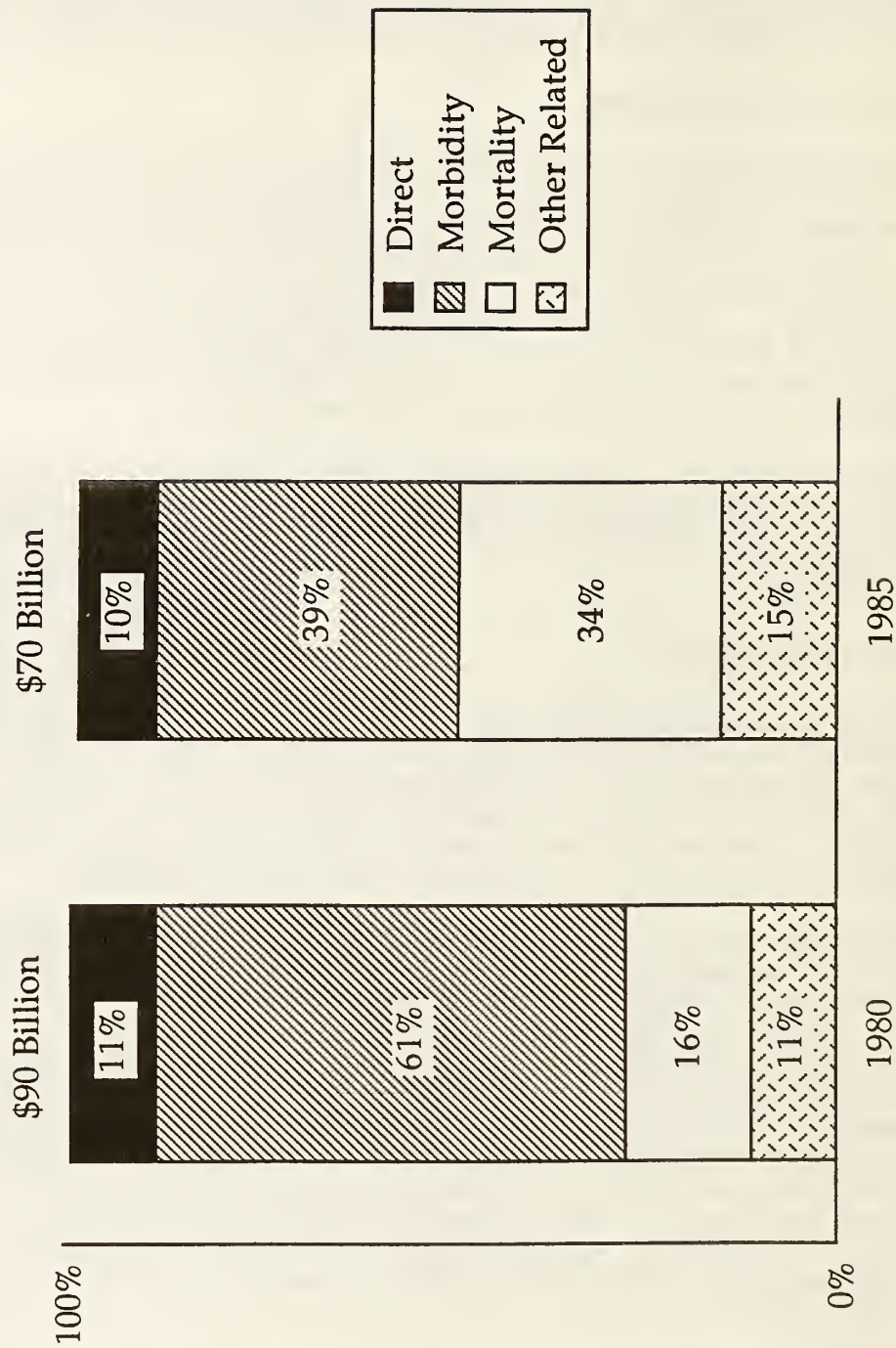


Figure 26

Distribution of Economic Costs of Drug Abuse by Type of Cost, 1980 and 1985

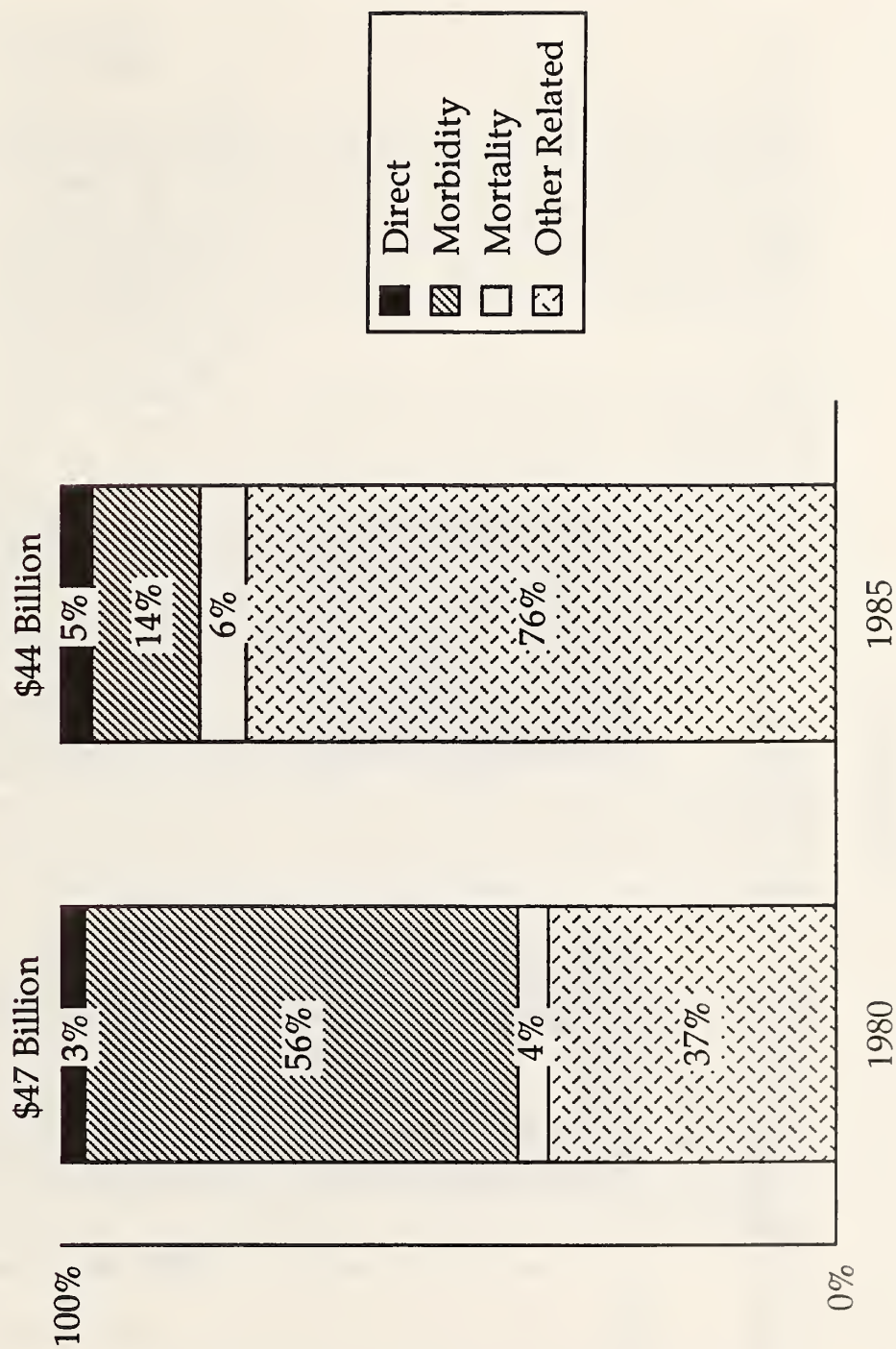
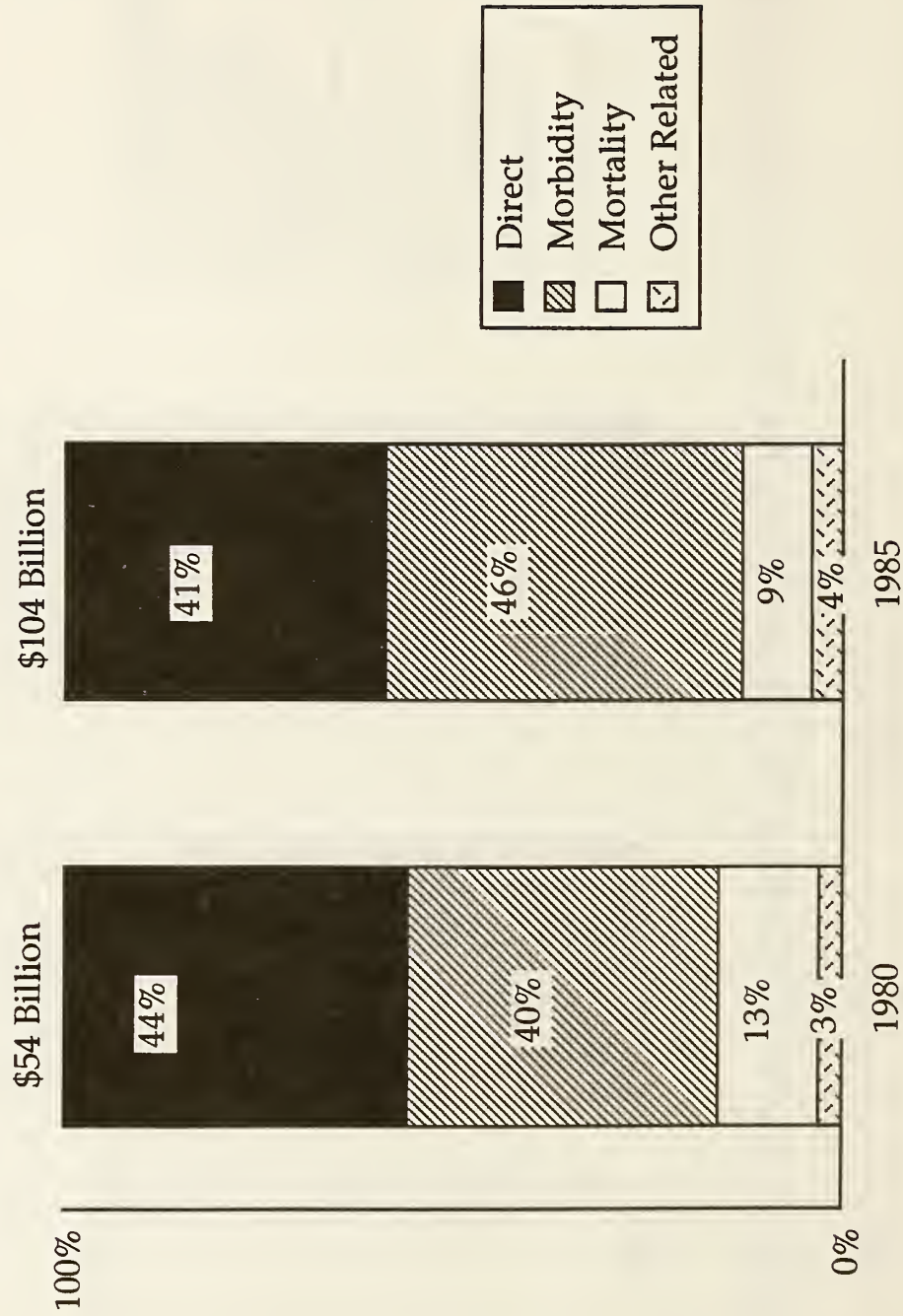


Figure 27

Distribution of Economic Costs of Mental Illness by Type of Cost, 1980 and 1985



description of the sources of differences in estimates for selected cost categories within the core costs.

Short-Stay Hospital Costs

Short-stay hospital costs are estimated herein at \$13.1 billion in 1985, of which \$10.2 billion is for hospitalizations with ADM primary diagnoses and \$2.9 billion is for hospitalizations involving ADM comorbidity. The RTI 1980 estimate for short-stay hospital costs was \$9.2 billion, including \$864 million for ADM care in non-federal general hospitals with separate psychiatric units. The 1985 total of \$13.1 billion represents expenditures for all ADM care in non-federal general hospitals (referred to as short-stay hospitals), including care in psychiatric units that could not be separated.

The RTI and UCSF studies used the same databases for their basic calculations – the National Hospital Discharge Survey for estimating days of care and the American Hospital Association costs per patient day. RTI did not estimate the cost of comorbidity, but they made estimates of hospitalization costs for alcohol-related illnesses based on proportions of the illnesses or diseases deemed to be ADM-related. A substantial part of the alcohol-related costs is included in our comorbidity estimates. We believe that our systematic approach to measuring the costs of comorbidity is a major contribution and improvement in more accurately estimating short-stay hospital costs due to ADM disorders.

Nursing Home Costs

The cost of nursing home care for patients suffering from alcoholism and mental illness is estimated herein at \$11.3 billion in 1985, compared with \$2.95 billion in 1980, a 282 percent difference. The RTI estimate for 1980 was based on the 1977 National Nursing Home Survey conducted by the National Center for Health Statistics and the 1985 estimates are based on the same survey conducted in 1985.

RTI used the indirect method described above (ratio of ADM nursing home residents to total residents applied to total expenditures for nursing home care reported in the National Health Accounts), while we used a flat annual charge applied to the number of ADM residents, including all listed diagnoses, as reported in the 1985 National Nursing Home Survey. The 282 percent difference in total spending for nursing home care was mainly due to differences in methodology, inflation in the nursing home market, and a small increase in utilization during this time period. Comparison of data for the total number of nursing home residents from the two surveys shows a 14 percent increase between 1977 and 1985 (NCHS, 1989).

Office-Based Physicians

The cost of care to ADM patients by office-based physicians is estimated herein at \$2.3 billion in 1985, 17 percent below the \$2.8 billion estimated by RTI in 1980. The periodic National Ambulatory Care Survey (NAMCS) was used as a basis for estimating the number of ADM visits in both years. RTI used the indirect method described above (ratio of ADM visits to total visits applied to the total expenditures for physicians' services reported in the National Health Accounts). We applied charges per visit to the ADM visits reported in the 1985

Table 76

ADM DIRECT CORE COSTS, 1980 AND 1985

<u>Type of Cost</u>	<u>1980</u>		<u>1985</u>		<u>Percent Change</u>
	<u>Amount (Millions)</u>	<u>Percent Distribution</u>	<u>Amount (Millions)</u>	<u>Percent Distribution</u>	
Total	\$34,770*	100.0%	\$51,420	100.0%	47.9
Short-Stay Hospitals	9,196	26.4	13,064	28.1	42.1
ADM Specialty Institutions	10,500	30.2	15,682	28.8	49.4
Nursing Homes	2,951	8.5	11,286	14.4	282.4
Office-Based Physicians	2,837	8.2	2,344	5.0	-17.4
Other Professional Services	2,757	7.9	3,656	7.8	32.6
Drugs	1,631	4.7	1,453	3.1	-10.9
Other Health Services	781	2.2	-	-	-
Volunteer Services	295	.8	-	-	-
Support Costs	3,823	11.0	3,935	7.9	2.9

* This figure is \$700 million lower than shown in Table 72 (\$35,470 million) due to differences reported in Tables III-1 and III-5 in Harwood et al., 1984.

NOTE: Numbers may not add to totals due to rounding.

NAMCS, the most recent survey conducted by the National Center for Health Statistics.

Other Professional Services

Expenditures for other professional services provided to ADM patients are estimated herein at \$3.7 billion in 1985 compared with \$2.8 billion in 1980, a 33 percent difference. We limited our estimates to expenditures for psychologists and social workers in this cost category. RTI used a method similar to ours for estimating psychologist costs, but then used the indirect method for the remainder of this cost category. In addition, RTI included estimates for dentist services (\$1.4 billion in 1980), employing the indirect method. We did not make estimates for this type of service because there is no reliable data source on which to base such estimates.

Drugs

Expenditures for drugs (pharmaceuticals) for ADM patients is estimated herein at \$1.5 billion in 1985 compared with \$1.6 billion in 1980. Again, we used a direct method of estimation based on psychotropic prescription drug sales, while RTI used the indirect method. RTI summed the ADM costs of treatment in those settings for which data were available and then applied the ratio of ADM costs to total costs, which was then multiplied by the total expenditures for drugs reported in the National Health Accounts.

Support Costs

Support costs for the provision of ADM health care in 1985 are estimated herein at \$3.9 billion, a slightly higher figure (3 percent) than the 1980 estimate of \$3.8 billion (Table 77). The main reason for the low 1985 estimate is that construction costs, amounting to \$844 million in 1980, are not included in the current study because there was no basis for making such estimates. RTI estimated these costs as a percentage of total national health expenditures. Review of this methodology raised questions regarding the appropriateness of using the proportion that ADM treatment costs are of total costs for all illnesses as a basis for estimating ADM construction costs.

For training costs, we used different sources of data yielding lower cost estimates. For health insurance administration, we employed a methodology similar to the RTI 1980 estimates for this cost category, resulting in total costs of \$2.3 billion in 1985 compared with \$1.4 billion in 1980, a 58 percent difference.

MORBIDITY COSTS

Estimates of ADM morbidity costs are presented in Chapter IV. Below, those costs are compared with estimates reported by RTI. In addition, the systematic and methodological differences in the two sets of estimates are also discussed.

Table 77

SUPPORT COSTS FOR THE PROVISION OF ADM HEALTH CARE, 1980 AND 1985
(millions)

<u>Cost Category</u>	<u>Total</u>		<u>Alcohol Abuse</u>		<u>Drug Abuse</u>		<u>Mental Illness</u>	
	<u>1980</u>	<u>1985</u>	<u>1980</u>	<u>1985</u>	<u>1980</u>	<u>1985</u>	<u>1980</u>	<u>1985</u>
Total	\$3,823	\$3,935	\$984	\$495	\$243	\$201	\$2,596	\$3,239
Research	492	337	38	53	113	66	340	218
Training	1,049	559	298	38	41	15	711	506
Construction	844	-	240	-	33	-	571	-
Health Insurance Administration	1,438	3,039	408	404	56	120	974	2,515

Comparison of Estimates

Table 78 compares the RTI estimates of ADM morbidity costs for 1980 with those of UCSF for 1985, unadjusted and adjusted for growth in earnings. In the comparison of the unadjusted data, two major differences are apparent:

- 1) Total indirect costs for 1985 are 21 percent less than the 1980 estimates, despite growth in total earnings of 45 percent over the same period (U.S. Bureau of the Census, 1987c, p. 411).
- 2) The distribution of morbidity costs attributed to alcohol abuse, drug abuse, and mental illness in 1985 is markedly different from that in 1980. In the 1985 estimates, the portions attributed to alcohol abuse (34 percent) and drug abuse (7 percent) are considerably lower than those for 1980 (53 percent and 25 percent, respectively). For mental illness, both the dollar amount and the percentage of total ADM morbidity costs more than doubled.

Two sets of changes underlie these differences: a) changes in the magnitude of real components of morbidity cost calculations between 1980 and 1985, and b) differences in the approach to estimating these costs. For the most part, the effects of these changes work in opposite directions, as described below.

The separation of these two sets of changes becomes apparent from a reworking of the basic identity introduced in Chapter IV. In that equation:

$$\text{\$LOSS} = \sum \sum \sum (\text{POP}_{ij} * \text{PREV}_{ijk})(b_{ijk} * Y_{ij})$$

where $\text{\$LOSS}$ is the aggregate loss in income due to ADM disorders;

POP_{ij} is the size of the population by age and sex;

PREV_{ijk} is the prevalence rate, by age, sex, and disorder;

b_{ijk} is the percentage income loss per individual with ADM disorders (impairment rates), by age, sex, and disorder; and

Y_{ij} is the average per capita income by age and sex for individuals without disorders.

Reorganizing terms slightly:

$$\text{\$LOSS} = \sum \sum \sum (\text{POP}_{ij} * Y_{ij}) * (\text{PREV}_{ijk} * b_{ijk}).$$

The meaning of this altered expression is that total morbidity costs are equal to aggregate earnings times the product of prevalence rates and impairment rates. Over the period 1980-1985, it may be assumed that *actual* prevalence rates and *actual* impairment rates remain unchanged, although for drug use there is some indication of decline in prevalence since 1979 (National Institutes of Health, 1989). Because the data sets used by RTI (1979 National Household Survey on Alcohol Abuse sponsored by NIAAA, and 1982 National Household Survey on Drug Abuse, sponsored by NIDA) and by UCSF (1980-1984 Epidemiologic Catchment Area (ECA) Surveys sponsored by NIMH) to

Table 78

ADM MORBIDITY COSTS, 1980 AND 1985

<u>Disorder</u>	<u>1980</u>		<u>1985</u>		<u>1980-1985</u>
	<u>Amount</u> <u>(millions)</u>	<u>Percent</u>	<u>Amount</u> <u>(millions)</u>	<u>Percent</u>	<u>Percent</u> <u>Difference</u>
<u>Unadjusted for Growth in Earnings</u>					
Total	\$102,372	100%	\$80,762	100%	-21%
Alcohol Abuse	54,680	53	27,388	34	-50
Drug Abuse	26,028	25	5,979	7	-77
Mental Illness	21,664	21	47,395	59	119
<u>Adjusted for Growth in Earnings, 1980-1985</u>					
Total	148,439	100	80,762	100	-46
Alcohol Abuse	79,286	53	27,388	34	-65
Drug Abuse	37,741	25	5,979	7	-84
Mental Illness	31,413	21	47,395	59	51

perform these calculations were based on surveys conducted at virtually the same time, unchanged prevalence and impairment rates are moot points for the purposes of comparison of estimates. The reference period for both estimates predates the advent of crack cocaine.

As a reasonable first approximation, the growth in *actual* morbidity costs (\$LOSS) is the sum of the growth rates of the terms on the right hand side of the expression. From the arguments above, therefore, the growth in the latter two terms over the period 1980-1985 is zero and the growth in total earned income is 45 percent. *Actual* morbidity costs, then, have probably grown by approximately 45 percent. Yet the change in total ADM morbidity estimates shows a 21 percent lower figure in 1985.

These relationships are shown in Figure 28. The upper line represents the trend in total morbidity costs as estimated for 1980 by RTI. The lower line represents the same trend, increasing at the same rate of aggregate earnings growth, but as estimated for 1985 by UCSF. The reason that the two lines are not parallel is that their slopes represent the *absolute* growth in morbidity costs. With equal *percentage* rates of growth, starting in 1980 at different levels, the absolute growth is greater in the series starting at the higher level: hence, the steeper slope in the RTI series.

Clearly, raw comparison of the two estimates is inappropriate. The observed 21 percent difference in estimates between RTI in 1980 and UCSF in 1985, therefore, understates the methodological differences between the two approaches. When the trend in earnings is added to RTI estimates (for 1985) or subtracted from UCSF estimates (for 1980), the adjusted difference between the two sets of estimates is 46 percent, using the (earlier and larger) RTI estimates as the base. These adjusted differences are shown in Table 78. Explanation for this 46 percent difference in adjusted total morbidity cost estimates and the corresponding differences in losses attributed to alcohol and drug abuse and mental illness is the subject of this section.

These methodological differences are numerous and result primarily from the availability of new and improved sources of data and computer software since the RTI study was completed. To an important degree, differences also result from varying opinions about how best to analyze and interpret existing sources of data.

Comparison of Approaches

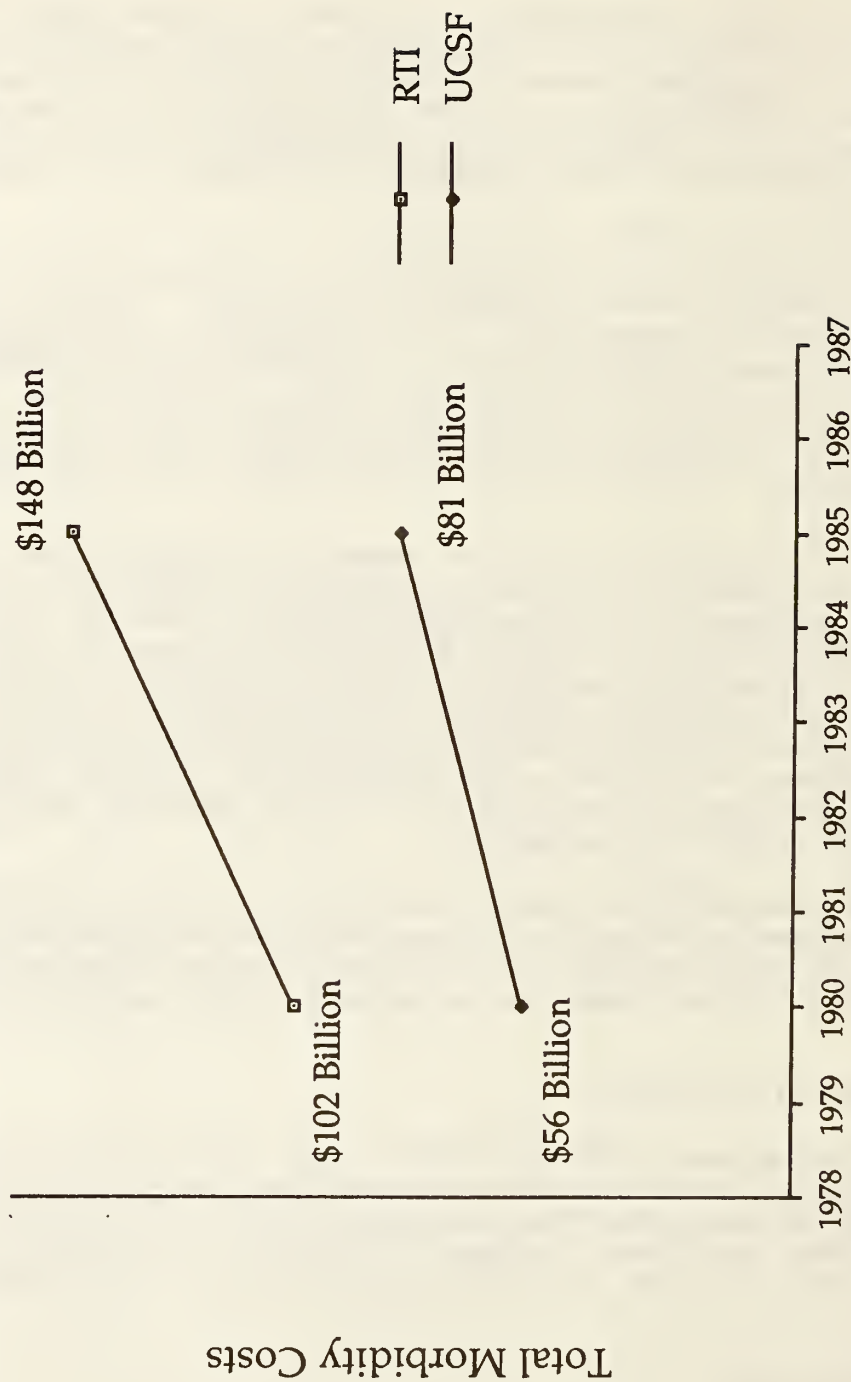
The approaches taken by RTI and UCSF are quite similar. Each bases the bulk of the calculations on the same four-component loss identity introduced in Chapter IV. The measurement of these components differs in the two studies. This section outlines the different contours of approach to the estimation of morbidity costs and discusses the methodological sources of the different findings.

RTI Analysis

The RTI analysis of morbidity costs divided the calculations between losses sustained by labor force participants and those sustained by individuals out of the labor force. The study of labor force participants was further divided into three separate studies: losses due to alcohol abuse, losses due to drug abuse,

Figure 28

Relationship Between RTI And UCSF Estimates of Total Morbidity Costs, 1980 - 1985



Source: UCSF

and losses due to mental illness. Similarly, three separate studies were performed on non-labor force participants.

Labor Force Participants. The study of labor force participants is referred to as "reduced productivity," since it is assumed that they are working; if suffering from ADM disorders, however, they are working at less than full effectiveness. Reduced productivity estimates comprised 78 percent of total ADM estimated morbidity costs overall, and 92 and 99 percent of costs attributable to alcohol and drug abuse, respectively.

Reduced productivity from alcohol abuse and from drug abuse was estimated by RTI in separate studies based on corresponding household surveys. From statistical analyses of these surveys, measures were obtained of the age- and sex-specific prevalence rates and impairment rates. These results were then applied to the corresponding size of the labor force and to the average level of year-round, full-time earnings. Mental illness estimates were based on imputations of loss due to partial and total disability since no household survey of mental illness was available at the time.

Prevalence Rates. The RTI study of losses due to alcohol abuse used a prevalence measure of problem drinking behavior (PD). Problem drinking is the presence of at least one of four selected behavior patterns secondary to alcohol abuse that tend to interfere with the normal conduct of life (See Appendix B for details). In its study of drug losses, RTI used a prevalence measure of daily marijuana use for a month or longer at any point in a person's life.

Impairment Rates. Based on these prevalence measures, the RTI study found income loss measures or impairment rates of 21 percent of expected income due to problem drinking and 27.9 percent for daily marijuana use. The estimated alcohol impairment rate is the subject of further discussion below.

Non-Labor Force Participants. Additional calculations of income loss were made by RTI for non-labor force participants assumed to be out of the labor force for reasons of ADM disorder. This component is referred to as "lost employment." With the exception of costs due to mental illness, this component of morbidity costs was relatively minor.

UCSF Analysis

In contrast, the UCSF approach, as described in Chapter IV, begins by dividing the calculations between the institutionalized and noninstitutionalized population; the noninstitutionalized population includes individuals in and out of the labor force. In addition, alcohol abuse, drug abuse, and mental illness are all estimated simultaneously, rather than in separate calculations using separate surveys and imputations.

The UCSF calculations are based on estimates of prevalence and impairment for all three disorders taken from the ECA survey. In contrast to behavioral prevalence measures used in the RTI study, those used in the UCSF study are diagnostic, based on DSM-III criteria (See Appendix B for details). These measures are applied to national estimates of the civilian noninstitutionalized resident population, by age and sex, and to measures of average per capita earnings for those with earnings, by age and sex.

Despite differences in the two approaches, there is a basic similarity in that both approaches are based on the same four-term identity yielding aggregate measures of national income loss due to alcohol abuse, drug abuse, and mental disorders. The differences between the two approaches arise from the manner in which estimates of those four measures are arrived at, described below.

Synthesis of the Difference in Approaches

While both studies employ the same general identity for the calculation of morbidity losses, the details of the calculations differ. The basic UCSF calculation is for morbidity losses among the civilian, noninstitutional population; to this is added an imputation for the institutionalized population. The basic RTI calculation is for morbidity losses among labor force participants; to this is added an imputation for noninstitutionalized persons out of the labor force and for the institutionalized population. In both studies, the added imputations are relatively minor (with the exception of lost productivity due to mental illness).

The sources of difference in estimates of income loss among the noninstitutionalized population by UCSF is compared with that among labor force participants by RTI. The differences in these estimates are the result of the respective forms of the basic identity used. For the two studies, the expression, as above, is:

$$\text{\$LOSS} = \sum \sum (\text{POP}_{ij} * \text{PREV}_{ijk})(b_{ijk} * Y_{ij}).$$

The RTI population figure is the number of labor force participants, whereas the UCSF one is the size of the noninstitutionalized population; the RTI prevalence rate is a behavioral measure among labor force participants, whereas the UCSF one is a diagnostic measure among the noninstitutionalized population. The impairment rates of the two studies differ in many ways (discussed below). The RTI income measure is year-round, full-time earnings; the UCSF one is the average earnings among those with any earnings. Because all of these quantities are measured separately by age and sex, and some also by disorder, the attempt to fully reconcile the two sets of estimates in a comprehensive way is beyond the means of this project.

Methodological Differences

Because the RTI study acknowledges that the reduced productivity estimates for mental illness were "incomplete," whereas those for alcohol and drug abuse were "relatively complete" and "partially complete," respectively (Harwood et al., 1984, p. 34), this discussion provides a quantitative characterization of the sources of different findings related only to alcohol abuse. A qualitative discussion of the differences related to drug abuse and mental illness follows. For more analytical detail on the UCSF approach to the estimation of morbidity costs for all three disorders, see Appendices B and C. Many differences in the details of the two approaches are described below.

Data Sets Used

Each research team used the best source of data at the time of the research. RTI used the household surveys sponsored by NIAAA and NIDA; UCSF used

the ECA survey sponsored by NIMH. The latter was selected over the more recent NIAAA and NIDA sponsored surveys for two reasons. First, only the ECA survey provides simultaneous diagnoses of alcohol and drug abuse and mental illness. Hence, only by using the ECA survey is it possible to provide separate, but mutually consistent estimates of morbidity costs for each of the three ADM disorder groups. Moreover, by using the ECA survey it is possible to determine income loss or impairment measures for each ADM disorder group while controlling for their joint prevalence. In this way, the problem of overlap (Harwood et al., 1984, pp. 113-115) is explicitly addressed.

Secondly, the ECA data permit the estimation of income loss measures due to ADM disorders based on personal income. While the 1985 National Household Survey on Drug Abuse (NHSDA) provides a measure of personal earnings (theoretically superior to the income measure), the 1984 National Alcohol Survey (NAS) provides only a measure of household income.

Other features of the ECA survey data are less than optimal, but these did not outweigh the apparent advantages of its use. Most notable is the fact that the ECA survey was conducted in parts of four urban and one rural area of the country. While the sampling design was highly sophisticated, the extrapolation of the data to national estimates is less reliable than for the two national household surveys. One of the four urban area surveys, moreover, did not collect income information and was thus unavailable to this study.

While some measure of the difference in estimates between UCSF and RTI may be attributable to sampling differences in the different surveys used, it is impossible to provide any estimate of that effect.

Model for Estimating Impairment Rates

Many features of the equation from which the income loss coefficients (impairment rates) were derived differ between the two studies. These are discussed below.

Life Cycle Timing of ADM Disorders. The RTI analysis uses dichotomous indicator measures of prevalence (indicator model), whereas the UCSF prevalence measures account for the duration, onset, and recency of the prevalence associated with each sampled person (timing model discussed in Appendix C). As a result, estimates of impairment or income loss are more closely calibrated to the timing of each person's disorder(s) than is the case in the RTI study. The effect is to lower the overall income loss measures and to provide age-specific estimates of loss, which are not possible with the simpler indicator model.

Table 79 shows the difference in UCSF estimates of morbidity costs of alcohol abuse among the noninstitutionalized population from using the timing and indicator models. As a result of using the timing model, UCSF estimates of morbidity costs due to alcohol are \$22 billion lower than they would have been had the indicator model been used. The calculations are based on the two sets of impairment rates reported in Appendix Table B-6.

Table 79

ESTIMATES OF AGGREGATE INCOME LOSS DUE TO ALCOHOL ABUSE,^{*}
INDICATOR VS. TIMING MODEL, 1985

(millions)

<u>Model</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>
Indicator Model	\$49,758	\$45,439	\$4,139
Timing Model	27,208	23,086	4,122
Difference	22,370	22,353	17

* Includes only noninstitutionalized population.

Income Measure-Dependent Variable. In both surveys available at the time of the RTI study, only household income was provided. To the degree that household income differs from personal income, household patterns of compensation for the impairment of household members masks or accentuates the measure of impairment. This compensation, borne out in the analysis of ECA data, introduces a bias into the estimates of individual impairment when household income is used. For that reason, UCSF, using personal income, produces different results from those found by RTI, using household income. Both studies use the natural logarithm of the respective income variable.

The effect of this difference is shown by estimating the UCSF income equation once with personal and once with household income as dependent variables, since both are provided in the ECA survey. These results are shown in Table 80. Line 1 of Table 80 shows the alcohol impairment rates resulting from the UCSF indicator model (since the difference attributable to the timing model has already been demonstrated). Lines 2 - 6 show the resulting impairment rates when individual RTI specifications are used. Line 2 shows the impairment rates resulting when household, rather than personal, income is used as the dependent variable. As is evident from the table, the male impairment rate declines noticeably, whereas the female rate almost triples, becoming highly significant. The results suggest that other household members may compensate by earning more in the presence of a male alcohol abuser and that the entire household is negatively affected by the presence of a female alcohol abuser. These results also may indicate that male alcohol abusers are more prevalent in households with higher than average household incomes, whereas female alcohol abusers are more prevalent in households with lower than average household incomes.

Structural vs. Reduced Form Equation. An important distinction between the two studies is that the income equation in the RTI study includes occupation and education variables, whereas the UCSF study deliberately excludes these variables from the analysis. If the analysis in either study had been conducted on a simultaneous equation basis (see Appendix B), the inclusion of these two

variables would be appropriate. With only a single equation analysis employed by both studies, however, inclusion of these variables results in an underestimate of income loss due to ADM. This underestimate results because lifetime prevalence of ADM disorders affect not only current income, but also lifetime educational and occupational achievement. By including these latter variables in the single equation treatment, these indirect effects of ADM on income are removed from estimates attributable directly to the prevalence measures used.

This effect is shown in line 3 of Table 80. In those results, alcohol impairment rates are reduced to 3.52 percent and 3.97 percent for males and females, respectively, although neither estimate is statistically significant.

Consideration of Overlap in ADM Disorders. An important limitation of the RTI study, noted in the report is that data sets available at the time could not account for overlap in the prevalence of ADM disorders (Harwood et al., 1984, pp. 113-115). To the degree that individuals with multiple ADM disorders are sampled in the NAS or NHSDA, all of their measured income loss is attributed to either alcohol or to drug abuse, resulting in an overstatement of the losses due to each of those disorders. The ECA survey provides the joint prevalence information necessary to correctly estimate the net contribution of alcohol abuse, drug abuse, and mental illness. The RTI study performed an arbitrary adjustment for overlap – 25 percent of the estimated alcohol and drug morbidity cost among the young is deducted to adjust for possible double counting of young alcohol and drug abusers.

Line 4 of Table 80 presents the measure of alcohol impairment that results when drug and mental illness variables are excluded from the income equation. In these results, the male impairment rate is virtually unchanged, whereas the female rate increases by almost 50 percent. The implication is that for men, there is a considerable prevalence of multiple disorders, but drug abuse and mental illnesses have effects on income that are independent of the effect of alcohol abuse; this does not appear to be the case for women.

Case Selection: Entire Population vs. Labor Force Participants. The RTI results were taken from regression analysis conducted on labor force participants only, whereas the UCSF analysis was conducted on the entire sampling frame of the surveys, the civilian noninstitutionalized resident population between the ages of 18 and 64. The UCSF specification was based on the verified hypothesis that a portion of the non-labor force participants were out of the labor force for reasons of ADM prevalence and confirmation that the analysis did identify the value of those losses.

An additional reason for this specification in the UCSF study is that there is a poor measure of labor force participation (months since last paying job) in the public use ECA data tapes. The results indicate considerably less income loss due to alcohol abuse for those who had worked within the last 12 months than was the case for the population as a whole. These are shown in line 5 of Table 80 where the male alcohol impairment rate falls by a third and the female rate is almost entirely eliminated (although both female rates are statistically insignificant).

Method of Statistical Estimation: Ordinary Least Squares vs. Grouped Data Maximum Likelihood Estimators. Income data available from all three surveys is provided in intervals. Using the interval midpoints as the measure of

Table 80

ALCOHOL IMPAIRMENT RATES UNDER DIFFERENT SPECIFICATIONS

Indicator Model, ECA Survey

	<u>Survey</u>	<u>Percent Impairment</u>	
		<u>Male</u>	<u>Female</u>
1. UCSF Model	ECA	-9.77***	-7.20
2. Household Income	ECA	-7.08**	-20.31***
3. Structural Equation	ECA	-3.52	-3.97
4. No Overlap	ECA	-9.71***	-10.50*
5. Labor Force Participants	ECA	-6.63**	-1.06
6. Ordinary Least Squares	ECA	-9.77***	-7.53*
7. RTI Model	ECA	1.44	-11.85**
Both Sexes			-0.14
8. RTI Model, Alcohol			-4.70

Significant Levels: * Significant at less than 0.1.
 ** Significant at less than 0.05.
 *** Significant at less than 0.005.

individual income for use in the dependent variable is less than optimal. It understates the variation in the dependent variable and results in biases in the estimates, where income is not symmetrically distributed both globally and within intervals. Recent software development has made possible estimating procedures that avoid these difficulties. The UCSF study employs the grouped data option of the mainframe-driven LIMDEP software (Greene, 1986). This is a maximum likelihood procedure, providing consistent parameter estimates, and can result in significantly different estimates from those obtained using ordinary least squares with interval midpoints.

In line 6 of Table 80, the same equation as in line 1 is estimated using ordinary least squares (weighted by sampling weights). Male impairment is unaffected and female impairment is slightly increased.

Summary of the RTI Model. A final equation was run incorporating all of these features of the RTI model, using the ECA survey data. The results of using household income, educational and occupational variables, no overlap, selecting for labor force participants only, and using weighted least squares are shown in line 7 of Table 80. When the equation was run separately by sex, the result for males showed a (statistically insignificant) positive relationship between income and an alcohol diagnosis. For females the impairment was strongly negative. For both sexes pooled (as the equation was estimated by RTI), the net result is a negligible and insignificant -0.14% (i.e. 1/7 of 1 percent).

Prevalence Variable

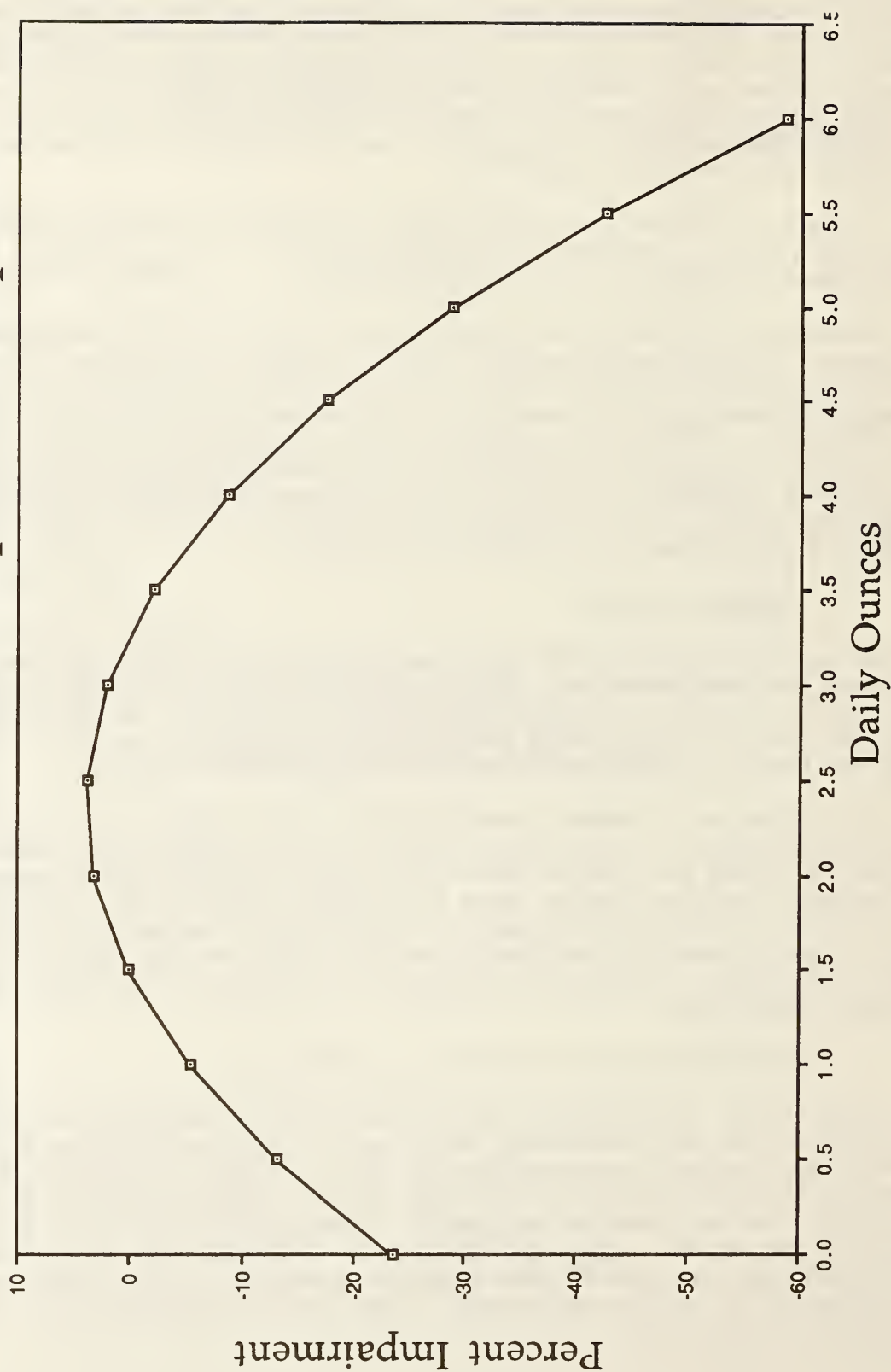
The surveys available to the respective research efforts provide the basis for different prevalence measures. From the NAS and NHSDA, the RTI study constructed a problem behavior measure for alcohol abuse and quantity/frequency of use measures for both drug and alcohol abuse. From the ECA survey, the UCSF study used DSM-III diagnostic disorder measures.

The difference in findings resulting from these different prevalence measures goes beyond the ability of the present study to establish. Conversions of the raw ECA data into problem behavior and quantity-frequency measures was attempted with poor results. Since the questions asked on the different surveys were not identical, the ability to reproduce identical prevalence measures across surveys is limited (See Appendix B). To some unknown degree, therefore, the different definitions of prevalence contributed to differences in morbidity cost estimates.

Extrapolation Method from Estimated Results

In their study, RTI described the effect of the use of alcohol on income with two measures: an indicator of the presence of problem drinking, and ounces of alcohol currently consumed per day. After extensive experimentation, they created an indicator of the presence of problem drinking from the self-report of any one (or more) of four specific alcohol-problem behaviors (See Appendix B for details). The effect on income of the quantity of alcohol consumed per day was explored with a quadratic specification; consumption per day was raised to the first and second powers and incorporated into the specification as two variables.

Figure 29: RTI Alcohol Impairment Equation



SOURCE: Figure drawn from equation in Harwood et al., 1984, p. A-17.

Three different specifications of the alcohol use variables were estimated for the sample of labor force participants (Harwood et al., 1984, p. A-17). The first contained only the problem drinking indicator; the second contained the quadratic specification of alcohol consumption per day; and the third contained both the problem drinking indicator and the quadratic specification of alcohol consumption per day. The RTI estimate of the coefficient on the problem drinking indicator in the specification that only included that variable (and control variables) (-0.138) suggests a 12.9 percent income loss among individuals exhibiting problem drinking behavior.

The specification that included both the problem drinking indicator and the quadratic form of consumption per day estimated the coefficient on the problem drinking indicator at -0.2357, which suggests a 21 percent loss of income associated with problem drinking. The losses associated with consumption per day varied with consumption levels as shown in Figure 29. Over the initial consumption range, losses diminished with increasing consumption levels, becoming a gain at about 1.5 ounces per day, maximizing gain at about 2.35 ounces per day, and then declining. At a little under 3.5 ounces per day, gains turned to losses, which continued to increase as consumption per day rose.

RTI argued that the specification based on both variables was their best result. In determining aggregate loss of income due to alcohol disorders, the average problem drinking prevalence rate and the average level of alcohol consumption per day should be estimated for each age-sex group and the percentage income loss for each group should be based on these averages. Instead, RTI omitted the alcohol consumption per day portion of the results and based the estimated loss on the 21 percent impairment implied by the coefficient on the problem drinking indicator in the specification that also included consumption per day.

By not using information about consumption per day in the income loss computations, RTI based those computations on the problem drinking indicator alone. Had they used the specification employing problem drinking only, the impairment rate would have been 12.9 percent rather than 21 percent. Their results, therefore, overstated the losses associated with alcohol abuse by 63 percent (21 percent/12.9 percent).

Measurement of the Alcohol Coefficient

In a separate regression analysis using the 1984 National Alcohol Survey, UCSF estimated the identical equation, described above, in which RTI found a problem drinking impairment rate of 12.9 percent, using the 1979 National Alcohol Survey. (The UCSF equation did not include a variable for children under age 12, since this was not available from the 1984 survey.) In that equation, UCSF found an (insignificant) impairment rate of 4.7 percent, but identical problem drinking prevalence rates to those found by RTI (See Appendix B). This result is shown in line 8 of Table 80. Table 81 compares these regression results and those reported by Heien and Pittman (1989), who attempted to replicate the RTI results.

It is difficult to explain these divergent results from virtually identical equations. The Heien and Pittman (H&P) estimates were based on unweighted regressions, whereas those of RTI and UCSF are both weighted by the sampling weights to adjust the estimates for post-survey stratification. All (except H&P2,

Table 81

COMPARISON OF ALCOHOL ABUSE COEFFICIENTS, RTI MODEL

Prevalence Measure*	Regression coefficient/(t-value)					UCSF2
	RTI1	UCSF1	RTI2	H&P1	H&P2	
ALC						-0.001 (-0.05)
PD	-0.138 (-2.33)	-0.048 (-1.215)	-0.237 (-3.82)	0.00049 (0.01)	0.0128 (0.44)	
QF			0.261 (5.59)	0.0055 (0.10)	0.0040 (0.07)	
QFSQ			-0.051 (-4.71)	0.0015 (0.15)	0.0016 (0.17)	

RSQ	0.396	0.265	0.484	0.406	NR	0.15
F	35.1	59.4	67.0	NR	NR	56
N	NR	2,989	NR	1,571	1,571	6,639
Survey	NIAAA 1979	NIAAA 1984	NIAAA 1979	NIAAA 1979	NIAAA 1979	ECA

RTI1: Income equation of labor force participants, ordinary least squares, weighted by sampling weights, 20 other independent variables.

UCSF1: Identical to RTI1, except for exclusion of variable indicating children under 12 (unavailable in 1984 NIAAA survey).

RTI2: Same as RTI1, but with Quantity/Frequency variables included; based on total population.

H&P1: Same as RTI2 except unweighted and (apparently) based on total population instead of labor force participants.

H&P2: Same as H&P1, except adjusted for selection bias.

UCSF2: Closest approximation of RTI1 using ECA survey. Log (Household income) regressed (WLS) on RTI RHS; selected for cases having worked in the past 12 months; drug and mental variables not included; data pooled for both sexes, weighted by post-survey stratification weights.

* For definition of prevalence measures, see text.

Table 81) were estimated with ordinary least squares. Use of the alcohol impairment rate found by UCSF (4.7 percent) would further reduce the difference between UCSF and RTI findings on income loss due to alcohol abuse.

Income Measure Used to Evaluate Aggregate Losses

A final difference between the two approaches is that in calculating aggregate income losses due to both alcohol and drug abuse, RTI used average year-round, full-time earnings, by age and sex, whereas UCSF used average earnings among those with any earnings, by age and sex. (Both included wage supplements in these calculations.) An analysis of relevant data (U.S. Bureau of the Census, 1987b) reveals that the ratio of full-time to average earnings in 1985 is 1.257 for men, 1.482 for women, and 1.367 for both sexes combined.

This is a major difference. If all non-year-round, full-time employment were attributable to the ADM population alone, then year-round, full-time earnings would clearly be the appropriate magnitude to use in determining income losses due to ADM disorders. Part-time employment is due to many factors in addition to ADM disorders, however, and RTI's use of year-round, full-time earnings further overstates the losses in income due to alcohol (and drug) disorders.

On the other hand, use of unadjusted average total earnings understates the losses due to ADM disorders since those losses are already inherent in actual average national earnings. The UCSF choice of the latter is based on a comparison of impairment rates reported in Appendix B, Table B-6 with the earnings ratios reported two paragraphs above. Although a single overall average ADM impairment rate was not estimated by UCSF, inspection of the rates reported in Appendix Table B-6 reveals that they are at or below 10 percent, which is closer to zero than to 26, 37, or 48 percent.

Quantitative Comparison of the Two Sets of Findings

Alcohol Abuse

An attempt to reconcile the two sets of findings by quantifying each of the above differences between the two studies can only be suggestive. The effects of two important differences – the surveys and types of prevalence measures used – cannot be quantified, and the effects of the factors evaluated separately below are unlikely to be independent of each other. The method of comparison is to calculate the effect of each of the measurable differences in approach, described above, on the UCSF measure of aggregate income loss due to alcohol abuse among the noninstitutionalized population.

Table 82 illustrates the attempt, nonetheless, to evaluate the factors described above in their influence over the different UCSF and RTI findings in aggregate morbidity costs due to alcohol abuse. Table 82 begins with the morbidity cost estimates for the noninstitutionalized population reported by UCSF in Table 41, since the relatively minor estimates of the institutionalized population in either study are not at issue. The numbered entries represent adjustments to the UCSF estimate based on calculations employing the RTI methodology.

Table 82

RECONCILIATION OF MORBIDITY COSTS DUE TO ALCOHOL ABUSE

	<u>Amount (millions)</u>
UCSF Estimate*	\$27,208
Adjustments to UCSF estimates	
(1) Timing Model	22,370
(2) Dependent Variable	-4,974
(3) Inclusion of Occupation and Education	-30,925
(4) Overlap	-6,282
(5) Case Selection	-18,133
(6) Least Squares Estimation	190
(7) RTI Alcohol Extrapolation	28,286
(8) RTI Alcohol Estimation	28,635
(9) Earnings Measure	13,673
"Corrected UCSF" (Total of above)	60,046
Adjusted RTI (See text)	73,333
Difference Unexplained	13,287

* Noninstitutionalized population only.

1) *The Timing Model.* The timing model shows the effect on the estimates of using the timing model (as previously described in Table 79). Hence, had UCSF, like RTI, used an indicator model, morbidity cost estimates for alcohol would have been \$22.4 billion higher.

2) *Dependent Variable.* The dependent variable shows the effect of using (the natural logarithm of) household income from ECA survey data rather than personal income as the dependent variable in the indicator model regression analysis. Male and female alcohol abuse morbidity cost estimates are adjusted by the corresponding ratios of impairment rates from Table 80, using personal and household income as the dependent variable. While male and female effects of changing dependent variables moved in opposite directions, on balance, morbidity costs due to alcohol abuse were \$5 billion lower when household income was used.

3) *Inclusion of Occupation and Education.* An important analytical difference between the UCSF and RTI models is that UCSF estimated a reduced form equation, whereas RTI estimated a structural equation in which endogenous variables for occupation and education are included. As discussed in Appendix B, because occupation and education are affected by ADM prevalence, their inclusion on the right-hand side of an income equation is expected to lower the measured effect of ADM on income impairment. Alcohol abuse impairment rates for men and women were lowered from 9.77 percent to 3.52 percent and from 7.20 percent to 3.97 percent, respectively, resulting in an adjustment of -\$31 billion to the UCSF estimate. This suggests that, had RTI estimated impairment rates without the inclusion of occupational and educational variables, the rates would have been two or more times larger than the rates reported.

4) *Overlap.* The difference attributable to the treatment of overlap in the two studies was determined by running the indicator model income equation with the alcohol prevalence measure (ALC) alone and comparing the resulting impairment rates with those resulting when all ADM variables are included in the equation. (In both of these equations, control variables were also included.) Morbidity costs were adjusted using the former impairment rates, and the amount was reduced by the overlap adjustment rendered by RTI. Since the overlap adjustments imputed by RTI were considerably greater than the overlap measure determined in the UCSF analysis, the net effect is negative. In other words, the \$8 billion reduction introduced by RTI (in 1980 dollars) was \$6.3 billion more than the effect found by UCSF.

5) *Case Selection.* The difference in results attributable to the different population bases of the impairment rate estimation was found by adjusting the original indicator model estimates by the corresponding ratios of impairment rates found when the equation is run on the entire population and when it is run on labor force participants only. This results in a reduction of \$18.1 billion. In other words, if the UCSF estimates had been obtained following the practice of RTI (labor force participants only), UCSF estimates would have been lower by \$18 billion (widening the difference between the two results).

6) *Least Squares Estimation.* A minor adjustment is made for the use of the estimating procedure of least squares rather than grouped data. This was calculated precisely the same as the above cases, using the corresponding ratios of impairment rates.

Table 83

NUMBER OF ADM DEATHS AND PRODUCTIVITY LOSSES,
1980 AND 1985

<u>Cause of Death</u>	<u>1980</u>		<u>1985</u>	
	<u>Number of Deaths</u>	<u>Productivity Losses (millions)</u>	<u>Number of Deaths</u>	<u>Productivity Losses (millions)</u>
	<u>Amount</u>			
Total	109,519	\$23,632	140,593	\$35,811
Alcohol Abuse	69,180	14,456	94,768	23,983
Drug Abuse	6,392	1,980	6,118	2,563
Mental Illness	33,947	7,196	39,707	9,265
	<u>Percent Distribution</u>			
Total	100.0	100.0	100.0	100.0
Alcohol Abuse	63.2	61.2	67.4	67.0
Drug Abuse	5.8	8.4	4.4	7.1
Mental Illness	31.0	30.4	28.2	25.9

7) *RTI Alcohol Extrapolation.* This is a correction for the inappropriate choice of alcohol impairment rate selected by RTI. Had they used the 12.9 percent rate rather than the 21 percent rate, their morbidity cost estimate (in 1985 dollars) would have been \$28.2 billion less ($\$73.3 \text{ billion} * (1 - 12.9/21)$).

8) *RTI Alcohol Estimation.* An adjustment is made for the UCSF estimate of the alcohol impairment rate obtained from the 1984 NAS. Reducing the \$73.3 billion by the \$28.2 billion reduction from the previous paragraph and then adjusting this by the ratio of 12.9 percent to 4.7 percent results in another \$28.6 billion reduction.

9) *Earnings Measure.* Finally, the earnings ratios of year-round, full time to total earnings for men and women was applied to the UCSF morbidity costs to each gender group, adding another \$13.7 billion.

Adding all these adjustments results in a "Corrected UCSF" estimate of \$60 billion, \$13.3 billion short of the adjusted (for inflation) RTI estimate. Such a reconciliation, it should be emphasized, is only suggestive. The incremental adjustments to UCSF estimates, based on the RTI model, are conducted as if each of these factors were independent of the others; they probably are not.

Drug Abuse

Much of the above discussion can be reproduced for the comparison of drug loss estimates between RTI and UCSF. For a number of reasons, however, this reconciliation is not attempted. First, the difference in drug loss estimates between RTI and UCSF is considerably larger than for alcohol. Table 78 shows that for alcohol abuse the UCSF estimate is 65 percent less than the adjusted RTI estimate; for drug abuse, the UCSF estimate is 84 percent less.

This degree of difference suggests a greater degree of non-comparability between the UCSF and RTI drug abuse estimates than is the case for alcohol abuse. In particular, the prevalence measures used were considerably different: Lifetime daily marijuana use for a month or longer was used by RTI, whereas UCSF used a lifetime medical diagnosis of abuse of or dependence on any of six different drug categories. Impairment rate differences between the two studies were even greater for drug abuse than for alcohol abuse.

In addition, the 1985 National Household Survey on Drug Abuse (NHSDA) changed in two ways that negated its use in helping to reconcile the two sets of findings. The income measure provided in that survey changed from household income to personal earnings. The later NHSDA survey did not provide the information necessary to reconstruct the marijuana prevalence variable used by RTI. As a result, the RTI results could not be updated and used alongside the UCSF results based on the ECA survey as was done with the alcohol reconciliation. An attempt to reproduce cross-survey prevalence rates was unsuccessful, since the relevant questions asked on the respective surveys were too dissimilar.

Mental Illness

No population-based surveys were available to RTI with which to estimate corresponding rates of impairment due to mental illness. As a result,

Table 84

ADM OTHER RELATED COSTS, 1980 AND 1985
(millions)

Type of Cost	Total		Alcohol Abuse		Drug Abuse		Mental Illness	
	1980	1985	1980	1985	1980	1985	1980	1985
Total	\$23,804*	\$47,510	\$6,674	\$10,546	\$16,198	\$32,461	\$932	\$4,503
Direct Costs	10,707	22,267	4,701	7,380	5,162	13,209	844	1,678
Criminal Justice System	7,162	14,210	2,063	3,734	4,464	9,508	635	968
Police Protection	3,147	7,736	445	1,338	2,300	5,810	402	588
Legal & Adjudication	1,350	1,649	206	274	974	1,108	170	267
State & Fed. Corrections	1,521	3,014	520	884	1,001	2,130	-	-
Local Corrections	1,144	1,811	892	1,238	189	460	63	113
Drug Traffic Control	537	1,555	-	-	537	1,555	-	-
Private Legal Defense	66	2,056	10	342	48	1,381	8	333
Property Destruction	135	934	24	175	111	759	-	-
Motor Vehicle Crashes (property loss)	2,185	2,584	2,185	2,584	-	-	-	-
Fire Destruction	381	457	381	457	-	-	-	-
Social Welfare Administration	241	471	38	88	2	6	201	377
Indirect Costs	13,097	25,243	1,973	3,166	11,036	19,252	88	2,825
Victims of Crime	1,017	1,307	172	465	845	842	-	-
Incarceration	3,355	7,460	1,801	2,701	1,466	4,434	88	325
Crime Careers	8,725	13,976	-	-	8,725	13,976	-	-
Family Caregivers	-	2,500	-	-	-	-	-	2,500

* This figure is \$5,418 million lower than shown in Table 72 (\$29,222 million) due to differences reported in Tables III-1 and III-28 in Harwood et al., 1984.

the morbidity cost estimates provided by RTI were characterized as "incomplete," and there is no reason to believe that they are in any way comparable. For this reason, no reconciliation is attempted.

MORTALITY COSTS

The total number of ADM deaths for 1985 was 140,593, representing a loss of \$35.8 billion to the economy. For 1980, RTI estimated the number of ADM deaths at 109,519, representing a loss of \$23.6 billion (Table 83). A 6 percent discount rate was employed for estimating lifetime earnings for both years. Differences are mainly due to two factors: (1) different definitions of ADM deaths, and (2) inflation in average weekly earnings, amounting to a 27 percent increase from 1980 to 1985 (U.S. Bureau of the Census, 1987c, p. 392).

With regard to the number of ADM deaths, the current study includes almost 25,600 more deaths that are due to alcoholism or are alcohol related than the earlier study. Recent studies have documented alcohol as a major contributing factor in deaths from other causes (Parker et al., 1985; Ravenholt, 1984; Roizen, 1985). For example, 5 percent of deaths from diabetes and from pneumonia and influenza are attributed to alcohol in the current study, adding more than 5,000 deaths. Additional alcohol-related deaths include more than 1,000 deaths due to cancer of the liver. Finally, many more deaths from injuries and accidents, homicides, and suicides are now included.

For drug abuse, the number of deaths is 4 percent lower for 1985 (6,118 compared with 6,392 for 1980). For mental illness, there are almost 6,000 more deaths in 1985, resulting from the inclusion of deaths due to neuroses, not included in the prior study.

We thus estimate that of the \$12.2 billion, or 52 percent difference in total mortality costs between 1980 and 1985, about half can be attributed to the rise in wages and salaries and the remainder to the inclusion of deaths attributed to alcohol-related illness and injuries and to mental disorders.

OTHER RELATED COSTS

The total figure for other related direct and indirect costs equals \$47.5 billion for 1985, double the \$23.8 billion estimated for 1980 (Table 84). Costs for some categories are difficult to compare due to inflation and differences in methodology, as well as sources of data used for calculating the estimates. These methodological changes and new data sources are discussed in Appendix D and are briefly reviewed below for each category.

Criminal Justice System

The 1985 cost estimates for police protection and legal and adjudication services were based on the number of known offenses reported and the number of offenses cleared by arrest. These data were not available to RTI, which based cost estimates for these categories on the total number of arrests per offense. Thus, the higher estimates for police protection in 1985 reflect in part the police costs in responding to and investigating criminal events before an arrest is made. There is also greater activity in recent years within law enforcement to

control the sale and manufacture of drugs. Hence, more offenses are being reported, resulting in higher numbers of arrests, convictions, and prison sentences.

Drug Traffic Control

Drug traffic control expenditures almost tripled, rising from \$537 million in 1980 to \$1.6 billion in 1985. The new figure, compiled by the U.S. Office of Management and Budget (1988), represents expenditures for both law enforcement and prevention programs by the Drug Enforcement Administration and many other federal agencies.

Private Legal Defense

RTI included ADM costs for private security in this cost category. These costs are not included in the present report because it is difficult to estimate the ADM causal factors in anticipation of possible crime that may or may not occur. Legal defense costs, however, are incurred after an ADM crime has been committed and thus can realistically be termed an other related direct cost. The 1985 costs for private legal defense are estimated at \$2.1 billion, a significantly higher estimate than for 1980 at \$66 million. The 1985 estimate was based on Bureau of the Census data on total annual payroll for legal services; RTI based their estimate on a percentage of the amount spent for public defense.

Property Destruction

Costs of lost property were estimated for three categories: destruction due to criminal acts, i.e. assault, robbery or burglary; destruction due to motor vehicle crashes; and destruction of property by fire. For all three elements, the estimates employ the same methodology as RTI and are based on the 1985 National Crime Survey Report. The 1985 estimate is seven times the 1980 figure, with total ADM costs equaling \$934 million compared to \$135 million in 1980. The 1985 cost estimate does not include accident investigation costs, which totaled \$176 million in 1980; comparable data were not available to estimate these costs for 1985.

Social Welfare Administration

Social welfare administration costs were calculated following the RTI methodology. The 1985 costs are approximately double those of 1980, rising from \$241 million to \$471 million due to the growth in social welfare expenditures.

Victims of Crime

The value of lost productivity for crime victims and those incarcerated in prisons are indirect costs, which are calculated using offense-specific causal factors for alcohol and drug abuse developed by RTI. The value of lost work time by crime victims increased from \$1.0 billion in 1980 to \$1.3 billion in 1985. The methodology used for 1985 was similar to that used for 1980, with updated sources of data.

Incarceration

Productivity losses due to incarceration more than doubled, increasing from \$3.4 billion in 1980 to \$7.5 billion in 1985. Losses due to incarceration for drug abuse increased most dramatically. In 1980, the largest amounts of productivity losses were represented by alcohol abuse, \$1.9 billion, compared to \$1.5 billion for drug abuse. In 1985, the largest amounts are reversed, with \$4.4 billion related to drugs compared to \$2.7 billion for alcoholism.

Crime Careers

The estimation of lost productivity in 1985 due to crime careers was calculated using an approach different from that of RTI, and making it difficult to compare with 1980 estimates. As discussed in Appendix D, the 1985 figure of \$14.0 billion is based on epidemiologic data obtained from NIDA and demographic data from the 1985 National Household Survey on Drug Abuse, as contrasted with an estimate of \$8.9 billion in 1980, based on the 1974 Treatment Outcome Prospective Survey (TOPS).

Family Caregivers

This is a new category of other related indirect costs not estimated by RTI. It represents the value of time lost by caregivers for care provided to mentally ill family members estimated at \$2.5 billion in 1985.

FETAL ALCOHOL SYNDROME

The estimate for 1980 of the direct costs of Fetal Alcohol Syndrome (FAS) was \$3.2 billion, a significantly higher figure than the \$1.6 billion used for the present study. The \$3.2 billion for 1980 included \$2.4 billion for direct costs and \$853 million as the value of lost employment and reduced productivity for adult FAS victims.

We are relying on a recent report by Abel and Sokol (1987) for our estimates. The cost estimates of Abel and Sokol (1987) differ from those of RTI in several ways. First, the Abel and Sokol incidence rate of 1.9 per 1,000 live births is considered more reliable than the incidence rate of 1.7 per 1,000 live births used by RTI because it is based on a larger number of incidence studies and reported cases of FAS. Thus, the annual estimates for neonatal intensive care are considerably higher in the Abel and Sokol study, \$20,000 to \$40,000, compared to \$3,500 in the RTI study. The former estimates are based on 1985 Institute of Medicine data not available for earlier study. Second, in their calculations, Abel and Sokol use an 18 percent post-natal mortality rate based on a study conducted by Streissguth et al. (1985). The third, and major, difference is that Abel and Sokol do not project their estimates beyond age 21. They assume instead that of the \$11.7 billion spent annually in the United States for residential care and support services for mentally retarded adults, 11 percent or \$1.3 billion is due to FAS. RTI provides lifetime cost estimates to age 65 and about half of the \$2.4 billion in direct costs is represented by the population aged 22-64 years.

Abel and Sokol found in their literature review that studies of mortality rates of the mentally retarded show they have a shorter life span than normal (Eyman, Borthwick, and Tarjan, 1984), and another recent study in animals

indicates prenatal alcohol exposure is associated with premature deaths (Church and Abel, 1986). In the absence of data regarding the lifespan of persons with FAS, Abel and Sokol believe the lifetime estimates determined by Harwood and Napolitano (1985) may be overstated.

A fourth and final difference between the two sets of estimates is that RTI included productivity losses amounting to \$853 million for the adult population currently suffering from FAS. We have omitted these indirect costs to avoid double counting. Persons who are currently employed or institutionalized are included in our morbidity cost estimates.

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GLOSSARY

SOURCES OF DATA

Annual Survey of Hospitals. A survey of all U.S. hospitals conducted annually since 1943 by the American Hospital Association. Information collected includes hospital classification, services, facilities, beds and utilization, financial data, personnel on payroll, and medical staff organization.

Drug Abuse Warning Network (DAWN). A continuing sample survey of 756 hospital emergency rooms and 75 medical examiners in 27 metropolitan areas in the United States. Information from emergency rooms includes demographic data, reason for visit and motivation for taking drugs, source of substance, and disposition of patient. Medical examiners report data on drug-involved deaths, including data on causes of death, demographic data, and drug involvement.

Epidemiologic Catchment Area (ECA) Program Community Surveys. Sample surveys in five sites conducted by universities between 1980 and 1985 and supported by the National Institute of Mental Health. The sites include St. Louis, Missouri (Washington University); Baltimore, Maryland (Johns Hopkins University); New Haven, Connecticut (Yale University); Durham, North Carolina (Duke University); and Los Angeles, California (University of California, Los Angeles). Data collected include frequencies of psychiatric disorders (DSM-III) using the NIMH Diagnostic Schedule (DIS), demographics, housing, income, alcohol and drug use, morbidity, and health care utilization.

Fatal Accident Reporting System (FARS). Data from traffic fatalities collected from police reports, hospitals, medical examiners and coroners, emergency medical services reports, state registration, driver licensing, highway department files, and death certificates. FARS is administered by the National Highway Traffic Safety Administration. Data are collected on time and location of the accident, age and sex of each person involved, alcohol involvement, and injury severity.

Inventory of General Hospital Psychiatric Services. A biennial survey of general hospitals with separate psychiatric services conducted by the National Institute of Mental Health. Data are collected on mental health resources in non-federal general hospitals, including caseload, staffing, financial expenditures, services, and auspices of program.

Inventory of Mental Health Organizations. A biennial survey of mental health organizations conducted by the National Institute of Mental Health. Included are psychiatric hospitals, non-federal general hospitals with psychiatric services, Veterans Administration psychiatric services, residential treatment centers for emotionally disturbed children, freestanding outpatient psychiatric clinics, and other types of partial care organizations. Data are collected on caseload, staffing, financial revenues and expenditures, services, aggregate patient characteristics, and auspices of program.

National Accident Surveillance System (NASS). A national random sample of police reports of motor vehicle crashes administered by the National Highway Traffic Safety Administration.

National Alcohol Survey (NAS). A periodic sample survey conducted by the Institute for Survey Research at Temple University and funded by the National Institute on Alcohol Abuse and Alcoholism. More than 5,000 interviews of adults aged 18 and over were conducted in 1985, with oversampling for Blacks and Hispanic respondents. Information was obtained on frequency and type of alcoholic beverage, drinking behaviors and immediate sequelae of drinking, including marital, employment, health, and accident problems.

National Ambulatory Medical Care Survey (NAMCS). A periodic national sample survey of ambulatory medical encounters with office-based, patient care physicians conducted by the National Center for Health Statistics. Excluded are visits to hospital-based physicians, specialists in anesthesiology, pathology, and radiology, and visits to physicians who are principally engaged in teaching, research, or administration. For the 1985 survey, a sample of 5,032 non-federal, office-based physicians was selected, providing data on 71,594 patient visits. Data are collected on patient age, sex, race, ethnicity, and reason for visit; physician's diagnostic and therapeutic services ordered or provided; diagnosis and disposition decision, and drugs prescribed.

National Crime Survey (NCS). A continuous survey, administered by the U.S. Department of Justice, of a representative sample of approximately 49,000 housing units across the United States inhabited by about 102,000 individuals aged 12 and over. The NCS concentrates on certain criminal offenses: the personal crimes of rape, robbery, assault, and larceny, and the household crimes of burglary, larceny, and motor vehicle theft. Both completed and attempted crimes are included in the survey. These crimes are examined from the perspective of their frequency, the characteristics of the victims and offenders, the circumstances surrounding the offenses and their impact, and the pattern of police reporting.

National Drug and Alcoholism Treatment Unit Survey (NDATUS). A national survey administered jointly by the National Institute on Alcohol Abuse and Alcoholism and the National Institute on Drug Abuse. The survey is designed to measure the scope and use of drug abuse and alcoholism treatment services throughout the United States. Statistical information is provided on physical environment, client population served, unit ownership, services provided, clients in treatment, and budgeted capacity.

National Health Accounts. Estimates of public and private expenditures in the United States compiled annually by the Health Care Financing Administration and published in the *Health Care Financing Review*. Data are provided by type of expenditure and source of funds.

National Health Interview Survey (NHIS). A continuing nationwide sample survey in which data on health status, acute and chronic conditions, and medical care use are collected through personal household interviews, administered by the National Center for Health Statistics. About 50,000 households with 125,000 persons are interviewed annually. In addition to a core set of questions repeated each year, supplementary questionnaires on current health topics change each year in response to the need for data on special topics.

National Hospital Discharge Survey (NHDS). A continuing nationwide sample survey of about 500 short-stay hospitals, administered by the National Center for Health Statistics. Within each sample hospital, a systematic random sample of discharges is selected and data are abstracted from about 200,000 medical records. Data are collected on admissions, length of stay, diagnoses, and procedures.

National Household Survey on Drug Abuse (NHSDA). A periodic household survey, conducted by the National Institute on Drug Abuse, of about 8,000 interviews in the United States to measure the prevalence of drug use among the population aged 12 and over. Information is collected on illicit drug users who have "ever used," "used in the past year," and "used in the past month." The following drugs or categories of drugs are examined: marijuana, cocaine, inhalants, hallucinogens, PCP, heroin, nonmedical use of four classes of psychotherapeutic drugs (stimulants, sedatives, tranquilizers, and analgesics), cigarettes and smokeless tobacco, and alcohol.

National Mortality Detail File (NMDF). Data from death certificates for all residents who die in the United States each year, administered by the National Center for Health Statistics. Included are demographic characteristics of the decedent and cause of death.

National Nursing Home Survey (NNHS). A periodic sample survey of nursing homes, administered by the National Center for Health Statistics. The 1985 survey data were obtained on the medical conditions and expenses of 6,023 discharges and 5,243 residents and on the characteristics and staffing of 1,079 facilities in which the patients reside.

Uniform Crime Reporting Program. Includes about 16,000 law enforcement agencies in the United States that provide data to the Federal Bureau of Investigation, U.S. Department of Justice, on the volume and trend of offenses known to the police, the nature and type of the offense, clearances of the offense, and persons arrested and charged.

ECONOMIC TERMS

Constant dollars. Dollars adjusted for inflation using a base year.

Core costs. Health care costs incurred by ADM-prevalent individuals. Included are direct expenditures for hospital and medical care and indirect costs, or the value of resources lost due to the illness.

Cost-of-illness studies. Studies that quantify the cost associated with a particular illness, based on either the prevalence or incidence of the illness. Most studies attempt to measure both direct and indirect costs.

Diagnosis-related group (DRG). Classification of patients used in the Medicare Prospective Payment System (PPS). Employed by the Health Care Financing Administration, some states, and some third-party payers as a basis for reimbursement for hospital inpatient care.

Direct costs. The actual dollar expenditures related to illness or disorder including amounts spent for hospital and nursing home care, physician and other medical professional services, drugs and appliances, and rehabilitation.

Discount rate. A rate used to convert a future stream of dollars into the present value equivalent. The higher the discount rate, the lower the present value of a given stream of dollars.

Human capital. An approach to valuing life in which productivity is based on market earnings and an imputed value for housekeeping services.

Impairment rate. The extent to which the effectiveness of a person's usual activity (working or housekeeping) is reduced. In the present study, the impairment rate represents the percent of income loss per individual with ADM disorders.

Indirect costs. The value of lost output due to the reduced or lost productivity caused by illness, disability, or injury. This includes the value of lost workdays and housekeeping days and lowered productivity due to illness or disability, and losses due to premature death.

Labor force participation rate. The proportion or percent of the population employed at a given point in time.

Life expectancy. The average number of years of life remaining to a person at a particular age based on a given set of age- and sex-specific death rates.

Market earnings. Wages and salaries earned in the labor market including supplements such as employers' contributions to social and health insurance.

Morbidity costs. The value of lost productivity by individuals alive at the end of the index year who are unable, due to illness or disability, to perform, or perform at a level of full effectiveness, their usual activities.

Mortality costs. The value of lost productivity due to premature death resulting from illness or injury. Lost productivity is calculated as the present discounted value of future market earnings plus an imputed value for housekeeping services.

Other related costs. Costs of the nonhealth effects of the illness. Included are direct costs of criminal justice, fire losses, motor vehicle crash losses, etc. Also included are indirect costs such as the value of productivity losses due to victimization by crime, incarceration, crime careers, and time spent by caregivers of persons suffering from the illness.

Person years lost. The number of years that an individual would have been alive in the absence of illness or impairment, based on the number of years of life expectancy remaining at the age of death.

Productivity loss. The value of output not produced due to illness or disability.

Reduced productivity. The value of losses to society due to impaired labor of employed persons suffering from illness.

Transfer payment. A payment that represents a transfer of funds from one payer to another and does not represent new goods or services produced. Insurance settlements, for example, are funds transferred from the insurance company to the hospital or individual to pay for medical services that have already been counted elsewhere.

Value of housekeeping services. An imputed value calculated by assigning the prevailing wage rate for performance of tasks similar to those performed by housekeepers. For example, time spent cooking might be valued using the prevailing wage rate for a cook.

Willingness to pay. An approach to valuing human life based on what an individual would be willing to pay for a change that reduces the probability of illness, disability, or death. It encompasses both the direct and indirect costs of illness.

CLINICAL AND EPIDEMIOLOGIC TERMS

ADM. The acronym used in this report to connote alcohol abuse, drug abuse, and mental illness.

Alcohol abuse. Any of the diagnoses listed in Appendix A under alcohol abuse with a code number listed in the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*.

Alcohol-related diagnosis. A diagnosis or illness in which alcohol abuse is not the principal diagnosis, but which is associated with alcohol abuse.

Cause of death. The underlying condition to which a death is attributed, based on information reported on the death certificate and utilizing the international rules for selecting the underlying cause of death from the reported conditions.

Crime careers. Activities of persons who engage in crime as a career rather than in legal employment.

Diagnostic and Statistical Manual of Mental Disorders (DSM-III and DSM-III-R). A classification system of mental disorders developed by the American Psychiatric Association, Edition 3 and Edition 3, revised.

Discharges. Persons released or discharged from inpatient care, including transfers to non-inpatient components and nonpsychiatric wards of non-federal general hospitals.

Drug abuse. Any of the diagnoses listed in Appendix A under drug abuse with a code number listed in the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*.

Incidence. The number of cases of illness or disease having their onset during a designated period of time. It is often expressed as a rate, such as the incidence of an illness per 1,000 persons during a year.

Inpatient days. Days that persons were physically present for 24 hours in the inpatient service during the year. Excludes days for which patients were on overnight or weekend pass or other short-term leave.

International Classification of Diseases (ICD) codes. A classification system of the nature of (N-codes) and external cause of (E-codes) illness and injuries, developed by the World Health Organization.

Length of stay. The number of days between the date of last admission and the discharge date, with persons discharged on the same day counted as having a 1-day stay.

Mental illness or disorder. Any of the diagnoses listed in Appendix A under mental illness with a code number listed in the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*.

Office-based physicians. Doctors of medicine or osteopathy who are licensed to practice medicine in one of the states or territories of the United States and who are classified by the American Medical Association through self-reporting as spending most of their time working in practices based in private offices. In the National Ambulatory Medical Care Survey, physicians with private offices in hospitals are included.

Organized care setting. Ambulatory medical care provided in hospital outpatient departments, emergency rooms, community mental health centers, and clinics.

Prevalence. The number of cases of a disease or disability in a population during a designated period of time, regardless of the onset or course of the disease or disability. It is often expressed as a rate, such as the prevalence of an illness per 1,000 persons during a year.

Primary diagnosis. The first-listed or principal diagnosis chiefly responsible for the admission of the patient to the hospital. In the National Hospital Discharge Survey, all diagnoses are listed on the face sheet of the medical record.

Psychiatric hospital (public or private). An entity either operated as a hospital by a state (e.g., state mental hospital) or licensed as a hospital by the state (e.g., private psychiatric hospital) and primarily concerned with providing inpatient care to mentally ill persons.

Secondary diagnosis. Any diagnosis following the principal or primary diagnosis listed on the face sheet of the medical record.

APPENDIX A

ALCOHOL ABUSE, DRUG ABUSE, AND MENTAL ILLNESS DIAGNOSES

DIAGNOSIS

ICD-9-CM CODE

ALCOHOL ABUSE

Alcohol Psychoses	291
Alcohol Dependence Syndrome	303
Alcohol Abuse	305.0
Alcoholic Polyneuropathy	357.5
Alcoholic Cardiomyopathy	425.5
Alcoholic Gastritis	535.3
Alcoholic Fatty Liver	571.0
Acute Alcoholic Hepatitis	571.1
Alcoholic Cirrhosis of Liver	571.2
Alcoholic Liver Damage, Unspec.	571.3
Fetal Alcohol Syndrome	760.71
Excessive Blood Level of Alcohol	790.3
Toxic Effects of Ethyl Alcohol	980.0
Accidental Poisoning by Alcoholic Beverages	E860.0
Accidental Poisoning by Other and Unspecified Ethyl Alcohol and its byproducts	E860.1
Examination for Medicolegal Reasons (Blood-Alcohol and Blood-Drug Tests)	V70.4

DRUG ABUSE

Drug Psychoses	292
Drug Dependence	304
Nondependent Abuse of Drugs	305
Polyneuropathy Due to Drugs	357.6
Narcotics Affecting Fetus or Newborn via Placenta or Breast	760.72
Hallucinogenic Agents Affecting Fetus or Newborn via Placenta or Breast	760.73
Drug Withdrawal Syndrome in Newborn	779.5
Poisoning by Opiates and Related Narcotics	965.0
Poisoning by Sedatives and Hypnotics	967
Poisoning by Central Nervous System Muscle- Tone Depressants	968.0
Poisoning by Psychotropic Agents	969
Poisoning by Central Nervous System Stimulants	970
Heroin Causing Adverse Effects in Therapeutic Use	E935.0
Methadone Causing Adverse Effects in Therapeutic Use	E935.1
Other Opiates and Related Narcotics Causing Adverse Effects in Therapeutic Use	E935.2
Sedatives and Hypnotics Causing Adverse Effects in Therapeutic Use	E937

Other Central Nervous System Depressants and Anesthetics Causing Adverse Effects in Therapeutic Use	E938
Psychotropic Agents Causing Adverse Effects in Therapeutic Use	E939
Central Nervous System Stimulants Causing Adverse Effects in Therapeutic Use	E940

MENTAL ILLNESS

Senile and Presenile Organic Psychotic Disorders	290
Transient Organic Psychotic Conditions	293
Other Organic Psychotic Conditions (Chronic)	294
Schizophrenic Disorders	295
Affective Psychoses	296
Paranoid States	297
Other Nonorganic Psychoses	298
Psychoses with Origin Specific to Childhood	299
Neurotic Disorders	300
Personality Disorders	301
Sexual Deviations and Disorders	302
Physiological Malfunction Arising from Mental Factors	306
Special Symptoms or Syndromes, Not Elsewhere Classified	307
Acute Reactions to Stress	308
Adjustment Reaction	309
Specific Nonpsychotic Mental Disorders Due to Organic Brain Damage	310
Depressive Disorders, Not Elsewhere Classified	311
Disturbance of Conduct, Not Elsewhere Classified	312
Disturbance of Emotion, Childhood and Adolescence	313
Hyperkinetic Syndrome of Childhood	314
Specific Delays in Development	315
Psychic Factors Associated with Diseases Classified Elsewhere	316
Mild Mental Retardation	317
Other Specified Mental Retardation	318
Unspecified Mental Retardation	319
Down's Syndrome	758.0
Patau's Syndrome	758.1
Edwards' Syndrome	758.2
Autosomal Deletion Syndrome	758.3
Hallucinations	780.1
Unspecified Sleep Disturbance	780.50
Other Insomnia	780.52
Other Hypersomnia	780.54
Disruptions of 24-Hour Sleep-Wake Cycle	780.55
Dysfunctions Associated with Sleep Stages or Arousal from Sleep	780.56
Other Sleep Disturbances	780.59
Other Symbolic Dysfunction	784.6

Senility Without Mention of Psychosis	797
Nervousness	799.2
Child Maltreatment Syndrome	995.5
Adult Maltreatment Syndrome	995.81
Shock Therapy as the Cause of Abnormal Reaction of Patient	E879.3
Suicide and Self-Inflicted Poisoning by Solid or Liquid Substances	E950
Suicide and Self-Inflicted Poisoning by Gases in Domestic Use	E951
Suicide and Self-Inflicted Poisoning by Other Gases and Vapors	E952
Suicide and Self-Inflicted Injury by Hanging, Strangulation and Suffocation	E953
Suicide and Self-Inflicted Injury by Drowning	E954
Suicide and Self-Inflicted Injury by Firearms and Explosives	E955
Suicide and Self-Inflicted Injury by Cutting and Piercing Instrument	E956
Suicide and Self-Inflicted Injury by Jumping From High Place	E957
Suicide and Self-Inflicted Injury by Other and Unspecified Means	E958
Late Effects of Self-Inflicted Injury	E959
Child Battering and Other Maltreatment	E967
Personal History of Mental Disorder	V11
Family History of Psychiatric Condition	V17.0
Family History of Mental Retardation	V18.4
Mental and Behavioral Problems	V40
Other Psychosocial Circumstances	V62
Convalescence Following Psychotherapy and Other Treatment for Mental Disorder	V66.3
Follow-Up Examination Following Psychotherapy and Other Treatment for Mental Disorder	V67.3
General Psychiatric Examination, Requested by Authority During Examination and Investigation of Individuals and Populations	V70.1
Observation for Suspected Mental Condition	V71.0
Special Screening for Mental Disorders and Developmental Handicaps	V79

APPENDIX B

ESTIMATION OF ADM IMPAIRMENT RATES

The analytical and statistical development of measures and estimates of ADM impairment rates and productivity loss reported in Chapter IV are elaborated below.

MEASUREMENT OF PRODUCTIVITY LOSSES: ANALYTICAL ISSUES

ADM morbidity costs are the economic output losses to society due to the prevalence of ADM disorders among living residents. Following the human capital approach to the estimation of these costs, they represent the loss in welfare resulting from the value of goods and services not produced as a result of ADM disabilities (See Chapter II for a discussion of human capital and willingness-to-pay approaches to the measurement of indirect costs).

Reduced Earnings as a Measure of Forgone Output

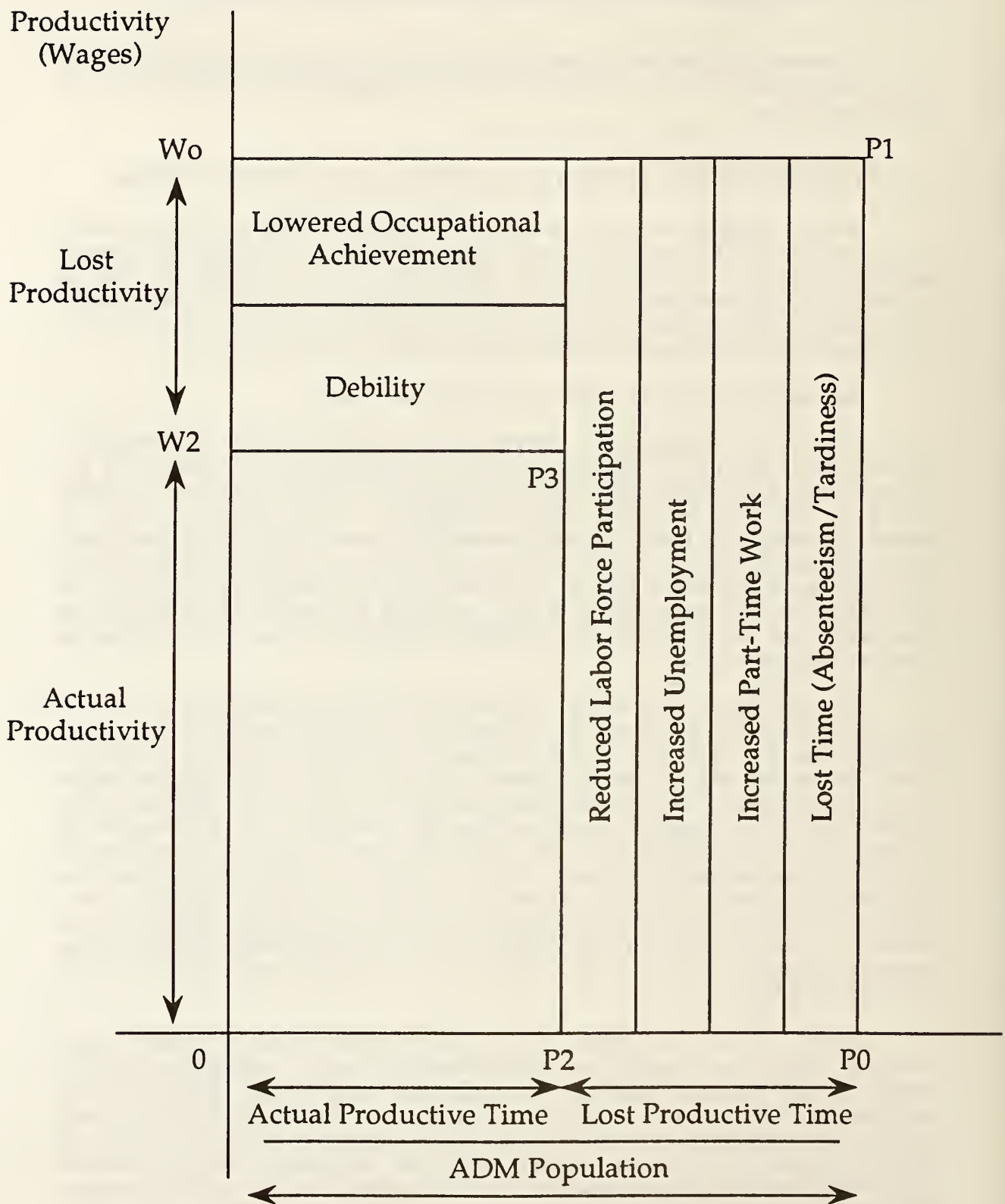
The obvious measurement problem of morbidity costs (as with mortality costs) is that data are not collected on what is not produced. Estimation of the value of output not produced for reasons associated with the prevalence of ADM disorders, therefore, must be made by inference. The inference is based on behavior presumed to take place in a competitive economy. In such an economy, with constant returns to scale, factors of production (labor and capital) are rewarded according to the marginal productivity of their services. Moreover, in such an economy total output is just equal to the sum, across factors of production, of the products of quantities employed times their respective marginal productivities.

Assuming that competitive markets prevail in all sectors, that wages and salaries paid reflect the actual productivity of individual effort, and that all reductions in output due to ADM disorders appear as reductions in the return to labor (wages and salaries, but not profits, interest or rent), the indirect morbidity costs of ADM disorders may be obtained from a measure of the depressing effects of ADM disorders on wages and salaries (earnings). In other words, an estimate of the morbidity costs of ADM disorders can be derived from a statistical characterization of the relationship between earned income and the presence or absence of ADM disorders, controlling for all other relevant factors. With a measure of the earnings-depressive effects of ADM disorders, total indirect morbidity costs can be obtained by multiplying these effects by the number of people with the disorders and the average incomes of persons without disorders.

In the real world, of course, many of these assumptions are less than fully realized, but at the present time this is the only model available within the human capital approach to permit the analytical translation of earnings loss to output loss. Because employers are not able either to perfectly match wages and salaries to productivity or to completely shift ADM-related capital losses onto labor, the measured statistical estimate of income loss will probably understate the actual losses in output resulting from the prevalence of ADM disorders. Moreover, to the degree that these estimates are based on income (earnings plus

Figure B-1

Components of Lost Output due to ADM Disorders



Source: Adapted from Cruze et al., 1981, Exhibit A-8.

transfers plus property income) rather than on earnings alone, the estimates may further understate actual output losses, since transfers will to some degree compensate for earnings losses.

Components of Income Loss

There are at least six avenues by which ADM disorders result in the reduction of earned income (Most of this section is adapted from Cruze et al., 1981, pp. A48-A51). These six avenues are shown in Figure B-1.

Lowered Occupational Achievement

Lowered occupational achievement results directly from ADM disorders and indirectly from lowered educational attainment, which also results from ADM disorders. Early onset of ADM disorders has been shown to reduce educational attainment (Mullahy and Sindelar, 1988). It is also expected to limit occupational achievement or career advancement. Persons suffering from ADM disorders are therefore expected to be less successful in career advancement at some point in their lifetimes than are persons without these disorders. To the degree that lower levels of achievement are compensated with lower levels of payment, reflecting the market valuation of such effort, these effects will be reflected in an analysis of incomes.

Reduced Labor Force Participation

Regardless of occupational achievement, reduced labor force participation is also expected in those with ADM disorders. Included are persons who are economically inactive as well as those in prisons and mental hospitals for ADM-related offenses or illnesses. Losses in income due to reduced labor force participation should be manifest in an analysis of earnings across the entire working-age population.

Increased Unemployment

Increased frequency or duration of unemployment is also expected for those with ADM disorders in the labor force, thereby reducing potential output and welfare to the degree that the unemployment is for personal mental health, not structural or cyclical reasons.

Increased Part-Time Work

Reduced full-time work is expected among employed individuals suffering from ADM disorders, thus reducing their work effort and resulting output, income, and welfare.

Lost Time

Lost time from occupational employment, absenteeism and tardiness, is expected for employed individuals suffering from ADM disorders. For those working for hourly wages, lost time will be reflected in their incomes. For those paid an annual salary, the lowered effect on work effort may be reflected in fewer raises and promotions, but the effect may also be averaged across job categories and not in individual incomes (This latter consideration limits our ability to accurately estimate morbidity costs from an analysis of earnings).

Debility: Reduced Productivity on the Job

Finally, employed people with ADM in the labor force are likely to work at lower levels of effectiveness than others in the same job categories and with similar qualifications and training (Salkever, 1985; Luft, 1975). To the degree that such individuals are compensated on a piecework basis, or their salaries contain merit components, or they are working in occupations beneath their training and cognitive or physical competence, these debilities will be reflected in their earnings.

These components of income loss are illustrated in Figure B-1. Lowered occupational achievement and debility reduce the productivity of each affected individual, whereas reduced labor force participation, increased unemployment, increased part-time work and lost time reduce their hours, days, or years of work (lowered productivity).

Although the figure is not drawn to scale, $OP_0P_1W_0$ represents the potential income to be earned by the ADM population in the absence of ADM disorders, but only $OP_2P_3W_2$ is actually earned. The estimated value of the difference of these two areas is reported in Chapter IV. This Appendix explains the technical basis of that estimate.

REVIEW OF PAST STUDIES

Estimation of the quantitative effects of ADM disorders on earnings is based on an analysis of survey data containing information on earnings, ADM prevalence, and other demographic information on individuals or groups of individuals. Until this study, no single source of data has contained separate and simultaneous information on each of the three ADM disorder classes for individuals surveyed. Thus, previous studies have investigated the separate indirect cost effects of ADM from different data sources. Three prior studies examine the effect of alcoholism on earnings (Berry et al., 1977; Harwood et al., 1984; Mullahy and Sindelar, 1988).

Berry and associates (1977) was the first empirical attempt to measure the effect of alcoholism on earnings. Using the 1968 National Alcohol Survey, they obtained a measure of income difference in households with male problem drinkers (large number of alcohol-related consequences). In that study, households with working-age male problem drinkers had incomes 18.4 percent lower than households with noninstitutionalized working-age males without drinking problems.

Limitations in the data prohibited controlling for demographic factors other than 10-year age brackets, which necessitated using household income differences as a measure of individual earnings effects, and blurred the effects of single versus multiple problem drinkers in the household.

Harwood and associates (1984) (hereinafter, RTI), using the 1979 National Alcohol Survey (Clark and Midanik, 1982) performed a multiple regression analysis of problem drinking on household income, controlling for demographic and labor market factors among labor force participants. The results of this analysis were supplemented with computed estimates of income losses among

individuals out of the labor force due to ADM causes (See Chapter IX for a more detailed description of the RTI study and its results).

The regression analysis of household income on problem drinking resulted in an estimate of a 21 percent earnings impairment. This estimate was used to calculate total "reduced productivity" in 1980 of \$58 billion. The value of "lost employment" among those out of the labor force due to alcoholism was estimated to be \$4 billion. A downward adjustment of \$8 billion was later made to "reduced productivity" to account for overlap with drug abuse among young problem drinkers. In addition, \$749 million was added to account for the income losses sustained by adult noninstitutionalized fetal alcohol syndrome victims.

In a review of the entire RTI study (Harwood et al., 1984) as it applies to the costs of alcohol abuse, Heien and Pittman (1989) offer a number of criticisms of the approach to the estimation of morbidity costs in that work. First, they suggest that the general approach taken by RTI requires the demographic homogeneity of problem drinkers and non-problem drinkers with respect to both profile and the effects of demographic variables on income. When applied to the data set used by RTI, these requirements fail appropriate statistical tests.

A second criticism centers on the income measure used in the analysis. The use of interval means for non-symmetrically distributed, interval-reported income results in biased regression estimates of the determinants of income. Moreover, the use of household income rather than personal earnings introduces further ambiguities to the interpretation of results. The presence of a working spouse or other household members or of non-wage income widens the difference between household income and respondent earnings, although it is the latter that is of theoretical interest.

Third, Heien and Pittman question the use of weighted least squares (WLS) as an appropriate regression technique on micro-level data. While they correctly point out that WLS is generally used to correct for heteroskedasticity (for which there is no indication in this study or type of data), they did not use the common (and correct) weighting (whether of least squares or other regression techniques) to correct parameter estimates across non-homogeneous populations for the effects of post-survey stratification. The weights used in the RTI study merely correct for the (inevitably) imperfect population sampling representation of individuals by age, sex, and race.

Fourth, and most significantly, when Heien and Pittman try to reproduce the RTI results from the 1979 National Alcohol Survey and RTI specification, they find no significant (ordinary least squares, OLS) relationship between problem drinking and income, whether corrected or uncorrected for sample selection bias. Whether the problem lies with RTI or with Heien and Pittman is impossible to determine from this study alone, but the difference in findings is almost certainly *not* a consequence of the use of WLS vs. OLS.

In their study, Heien and Pittman give no indication of which mutually exclusive education and occupation categories were excluded from their specification. Inspection of Table 3 suggests that none was excluded. While this should prohibit the possibility of obtaining any results at all (the impossibility of inverting a matrix of less than full rank), depending on the computational algorithm contained in the software used, it is conceivable that program output failed to disclose this difficulty.

The first study of the income depressive effects of alcohol problems using the ECA survey results was conducted by Mullahy and Sindelar (1988). They were concerned with characterizing life-cycle, labor market behavior in the presence or absence of alcohol and mental health problems rather than in providing national estimates of income losses. They used the data from one survey site (New Haven) rather than that from four or five sites. The authors specified a four-equation model (see below) describing the determinants of and interdependencies among education, occupation, labor force participation, and earnings.

Mullahy and Sindelar calculated ordinary and two-stage least squares estimates of the effects of alcohol abuse or dependence and mental illness (two separate variables) on earnings, measured as the natural logarithm of personal income (individual earnings, transfers, and property income). Observations were restricted to males, 25-59 years old. In the estimates of income regressed on the demographic variables, education, and recent symptoms of alcoholism or mental illness, no substantial or significant effect of alcoholism was found on income. A 20 percent depressive effect of mental illness on income, with marginal statistical significance, was found where occupation was excluded from the equation. In the two-stage least squares estimate of the effect of alcoholism on income, a 23 percent reduction was found having marginal statistical significance. Also, since education is used in the income equation, it is important to note that Mullahy and Sindelar found a one-year lifetime reduction in educational achievement among males with early onset of drinking problems.

Using the 1982 National Household Survey on Drug Abuse (NHSDA), Harwood and associates (1984) performed an analysis (similar to their work on alcoholism described above) of the effect of marijuana use on earnings. Using a prevalence measure of any lifetime daily marijuana use for a month or longer, they found an average impairment effect of 28 percent on the (household) income of labor force participants. The effect was highly significant statistically.

Rendering income loss estimates attributable to both alcohol and drug abuse from separate surveys and statistical analyses, however, introduces a problem of double counting, based on the degree of alcohol and drug abuse overlap in the working-age, active population. Harwood and associates adjust for this problem by reducing calculated losses among the under-35 age groups by 25 percent.

Bartel and Taubman (1979; 1986) used the National Academy of Science National Research Council panel of twins to analyze the effect of mental disorders on earnings. In the 1979 study, they reported a 24 percent reduction in 1973 earnings due to the presence of a psychiatric diagnosis made during the previous five years. In the 1986 study, distinguishing between psychosis and neurosis, they found 37 percent and 11 percent reductions, respectively, for diagnoses made during the previous five years. Overall earnings loss due to all mental disorders was estimated to be 24 percent. In their 1981 study, Benham and Benham (1982) used a sample of 244 men and found an earnings reduction of approximately 30 percent due to psychosis, no effect due to alcoholism, and a positive effect due to neurosis.

Finally, Frank and Gertler (1988), using the Baltimore site data of the ECA survey, found a 26 percent reduction in personal income as a result of "mental

distress," defined as a composite of three different measures of psychiatric diagnosis, among males aged 18-64. In order to minimize the possibility of false-positive diagnoses, the authors use a dichotomous prevalence variable having the value of one if a respondent satisfies the criteria for two of the three measures. The three measures were: 1) a clinical diagnosis, based on responses to the Diagnostic Interview Schedule (Robins, 1985); 2) a score of 4 or more on the General Health Questionnaire (Goldberg, 1971); and 3) self-reported recent mental health disability days.

SPECIFICATION OF THE ANALYTICAL MODEL

We begin from a model of individual earnings, which, of necessity, is a life cycle model of behavior. At the outset, individual earnings are assumed to reflect initial circumstances such as parental education, occupation, and income and other familial characteristics such as values, ambition, and mental health status. Included in mental health status is the presence or absence of ADM disorders. With these initial circumstances, individuals develop their own attitudes and ambitions, mental and physical health or illness, educational and occupational achievement, family and other responsibilities, and earn accordingly.

In algebraic terms, some of these relationships are bi-directional. While alcohol abuse, for example, may lead to a reduction in income, other things held constant, it also may be that lower socioeconomic circumstances lead to a greater likelihood of alcohol abuse and lowered ambitions. Under these circumstances, attributing all of the statistical relationship between alcohol abuse and income to the effect of alcohol on income is to ignore the effect of income on alcohol abuse and overstates the income depressive effects of alcohol.

The statistical analysis described below is an effort to determine the joint and separate contributions of ADM disorders to reductions in earnings. The standard formulation of the above model can be viewed as a four-equation system as follows (Mullahy and Sindelar, 1988):

- 1) $INC = f_1(AGE, SEX, \dots, OCC, A_1, D_1, M_1)$
- 2) $LFP = f_2(AGE, SEX, \dots, OCC, A_2, D_2, M_2)$
- 3) $OCC = f_3(AGE, SEX, \dots, EDUC, A_3, D_3, M_3)$
- 4) $EDUC = f_4(AGE, SEX, \dots, A_4, D_4, M_4)$

in which INC is annual earnings
 LFP is labor force participation
 OCC is occupation
 $EDUC$ is years of educational attainment
 A_i, D_i, M_i are various measures of ADM prevalence.

In this model education is determined by demographic factors and early onset of ADM alone; education (along with other variables) in turn determines occupational achievement; occupational achievement and other demographic and ADM factors determine labor force participation; and occupation, finally, along with other variables, including ADM, determines income among those in

the labor force. In principle, (simultaneous equation) methods for estimating the parameters of a model of this nature are straightforward, where data for the appropriate variables are available and the individual equations are identified.

STATISTICAL MODEL

Three general departures from the model outlined above are taken in the estimation process of the present study: 1) these relationships are measured in a single reduced form equation, rather than in a system of simultaneous equations; 2) income, the dependent variable, is measured logarithmically; and 3) specific recognition of the life cycle timing of disorders is incorporated into the estimation of income loss rates.

Reduced Form Estimation

There are two alternative statistical approaches to the estimation of income in the model described above. The direct approach is to estimate each of the structural equations in the model, using appropriate simultaneous equation methods. A second is to estimate a reduced form equation for income. A reduced form equation is an equation in which an endogenous (dependent) variable is solved in terms of the predetermined (independent) variables in the model, so that no endogenous variables remain on the right-hand side of the equation. Removing the source of simultaneous equation bias removes many of the statistical difficulties of estimating structural equations.

A reduced form equation provides estimates of both direct and indirect effects of predetermined variables on the dependent variable, whereas a structural equation, such as Equation (1) above, only provides estimates of the direct effects. In Equation (1) the effect of A_1 (alcohol abuse) on income is measured after controlling for occupation. For those with early onset of alcoholism, both educational and occupational achievement may be retarded; these indirect effects of alcohol abuse will be reflected in the occupation variable, not in the alcoholism measure. In order for direct *and* indirect effects of alcoholism to be captured by structural equations, all equations in the system must be estimated. The endogenous variable in question (Income), is then solved for the (predetermined) alcohol abuse variables in the system. Only in that way are the direct and indirect ADM life cycle effects on income captured.

Use of a reduced form equation more directly and simply captures both the direct and indirect effects of ADM disorders on income. The important predetermined (independent) variables in all of the structural equations must be included in the reduced form equation, implying that it should technically include all variants of ADM measures appearing in the structural model. Since the introduction of multiple measures of prevalence for each disorder would (and did) introduce intractable problems of collinearity, the equation only includes one lifetime prevalence measure for each of the ADM disorders measured. This simplification is not expected to seriously affect the results. Use of a reduced form equation, moreover, avoids the potential problem of one or more of the structural equations not being identifiable (statistically unique).

As a result of these considerations, a single reduced-form equation for (the natural logarithm of) income is estimated, based on all of the predetermined variables in each of the equations, including the indicators for ADM disorders.

Whether lifetime measures of ADM disorders are truly independent of income is questionable (the problem of "least squares bias"), but this problem was treated as if predetermined in the following analysis (Mullahy and Sindelar, 1988; Heine and Pompelli, 1987).

The calculation of income loss due to ADM disorders among the noninstitutionalized population is taken from the three-way product of ADM impairment coefficients in the reduced form income equation times the number of ADM prevalent individuals in the civilian noninstitutionalized resident population times the average income of non-disordered individuals.

The Logarithmic Measurement of Income

Estimation of the determinants of income are usually based on an assumption that the independent variables have proportional, rather than absolute, effects on income. For example, we may assume that it is more appropriate to specify that a diagnosis of alcoholism will reduce a person's income by 10 percent, rather than by, say, \$2,000 (Harwood et al., 1984; Mullahy and Sindelar, 1988; Frank and Gertler, 1988). While either assumption is somewhat arbitrary, that of absolute effect is clearly less tenable.

When the effect of independent variables is assumed to be proportional to the dependent variable, the natural logarithm of the dependent variable (income) is regressed on the normal values of the independent variables. The resulting regression coefficients then represent (biased) estimates of the percentage effects of the independent variables on the dependent variable. The bias in these estimates is then removed by transforming ("smearing") the coefficients with the expression

$$\text{antilogarithm}_e(\text{coefficient}) - 1 \text{ (Duan, 1983).}$$

This transformation has the effect of exponentially lowering negative and increasing positive coefficient values.

The Timing of Disorders

Estimates of income loss due to ADM disorders have heretofore employed simple dichotomous indicator (dummy variable) measures of individual prevalence. This treatment characterizes specific disorders as identically experienced in each prevalent sample individual. Loss measures represent the simplest income comparison between those with and those without the disorders. That simplifying restriction is relaxed in the analysis conducted herein. In the estimation of income loss measures, specific account is taken of the timing and duration of disorders within the lifetimes of prevalent sample individuals. More detail on the models and procedures used in specifying the timing of ADM disorders is provided below in the section on Prevalence: Measurement of ADM Disorders. Further detail is provided in Appendix C.

SELECTION OF A DATABASE

Having described the underlying analytical model and the statistical model to be used to estimate it, we now turn to the question of the database to be

used in the estimation. Three different probability-based surveys are available, each with advantages and disadvantages.

Available data sets

Between 1980 and 1985 three different surveys containing some measures of ADM prevalence and income became available for study. These surveys are described and contrasted below.

National Alcohol Survey (NAS)

In the summer and fall of 1984, the National Institute on Alcoholism and Alcohol Abuse (NIAAA) conducted the NAS, yielding a national probability household sample of over 4,000 usable cases between the ages of 18 and 64. The survey contains extensive information on behavior, attitudes, and quantity and frequency of lifetime consumption of alcohol. The survey also contains a brief set of questions on type and frequency of drug use during the previous 12 months. Data on mental illness are not included in the survey.

The alcohol survey also contains data on age, sex, educational achievement, labor force status, occupation, and household income. This latter is a limitation, since the analytical and statistical models presume the availability of *personal* income, if not earnings.

National Household Survey on Drug Abuse (NHSDA)

During 1985, the NHSDA sponsored by the National Institute on Drug Abuse (NIDA), was conducted. The NHSDA provided a national probability household sample of close to 5,000 usable cases between the ages of 18 and 64. The survey contains extensive information on behavior, attitudes, and quantity and frequency of consumption (primarily during the previous 12 months) of drugs of various types.

The survey also provides quantity and frequency of consumption information on alcohol. Like the alcohol survey, the drug survey contains no usable information on mental illness. The survey, finally, contains information on age, sex, marital status, number of children, educational and occupational achievement and personal earnings. An additional point to note, as discussed in Chapter IX, is that the 1985 survey questionnaire does not provide data for the measurement of the same lifetime marijuana use variable used by Harwood and associates (1984), whose study was based on the 1982 NHSDA survey.

Epidemiologic Catchment Area (ECA) Survey

The results reported here and in Chapter IV are based on the National Institute of Mental Health (NIMH) Epidemiologic Catchment Area (ECA) Survey Public Use Data Tape, Wave 1 Household Sample. The survey is the largest and most comprehensive survey of mental disorders ever conducted in the United States. The ECA program comprises a series of five epidemiologic research studies performed between 1980 and 1984 by five independent research teams in collaboration with NIMH Division of Biometry and Epidemiology. The five research studies were carried out by Yale University, Johns Hopkins University, Washington University, Duke University, and the University of California at Los Angeles.

Over 18,000 individuals, aged 18 and over, were interviewed in the Wave 1 household community sample, a multistage probability sample of regions, households, and respondents. Because one of the site surveys did not collect data on income, the ECA provided over 9,000 usable cases between the ages of 18 and 64.

The focus of the survey is the determination of reliable, community-based estimates of the prevalence of diagnostically defined mental disorders. At the core of the survey is the Diagnostic Interview Schedule (DIS), a structured questionnaire administered by lay interviewers to elicit data for computer-generated diagnoses, according to the criteria specified in the Diagnostic and Statistical Manual, Third Edition, 1980 (DSM-III), of the American Psychiatric Association (Robins, 1985; Anthony et al., 1985). Data provide diagnoses not only for mental illness but also for drug and alcohol abuse and dependence. In addition to the diagnostic information there is also demographic and economic information on each respondent, including data on age, sex, race, household and personal income, marital status, number of children, years of education, occupation, recency of last employment, and receipt of various transfer payments.

Selection criteria

A number of considerations entered into the decision of what survey or combination of surveys to use in obtaining estimates of morbidity costs. The overriding criterion was to base the estimates on data sets that could be expected to minimize the difficulties encountered. This was not a simple choice, since each of the data sets presents unique characteristics. Specific considerations entering into the choice included the following:

- 1) Data available to measure the important variables appearing in the specification of the statistical model, especially the dependent variable and prevalence measures consistent with the underlying analytical model;
- 2) Ability to measure income losses due to alcohol abuse, drug abuse, and mental disorders jointly and consistently;
- 3) Data from a sample likely to provide reliable national estimates;
- 4) Sample sizes large enough to allow for estimates that could pass the usual statistical tests of reliability; and
- 5) Data allowing for an approach consistent with that of Harwood and associates (1984).

Choice of ECA

The ECA survey was chosen as the best and only data set on which to base the requisite estimates. Overriding considerations were the ability to provide joint and consistent measures of lifetime ADM prevalence and impairment due to that prevalence. Because episodes of disorder prior to the interview year can be expected (through their effects on educational and occupational attainment) to

influence the level of earnings in the current year, the NIDA and NIAAA survey data were judged less satisfactory. In addition, the ECA prevalence data permit the formulation of a timing model in which the duration and timing of all ADM disorders is accounted for in the estimation of impairment rates.

SELECTION AND MEASUREMENT OF VARIABLES

The variables used in the estimation of the reduced form income equation are described below.

Demographic and Economic Variables

Income

The ECA data set provides self-reported measures of household income and personal income, within 18 brackets from \$0 to \$50,000 and over. Since the Washington University study team did not collect this income information for the St. Louis site, all of the St. Louis respondents were excluded from the analysis.

Personal income is not the perfect measure for this analysis, since it includes transfer payments and property income, neither of which are earnings and neither of which, therefore, reflect output produced. The data set does provide categorical indications of whether or not personal income included transfer payments in each of four categories: unemployment compensation, social security, disability payments, and welfare. Although this information could be used in the INCOME equation as dummy variables to control for the receipt of transfer payments, it is not independent of the level of income and would therefore necessitate the estimation of equations for each of the dummy variables used and two-stage estimation of the INCOME equation. Since these auxiliary equations could not be identified *a priori*, and the two-stage estimation was not feasible, adjustment for the receipt of transfer income was ignored.

Frank and Gertler (1988) report significant negative coefficients on these variables in an income equation, confirming that they are jointly determined with income. The structural parameter estimates on these variables should be positive, since the receipt of transfer or any other income (all other things held constant) increases one's income.

Provision in the data set of both household and personal income made available a measure of OTHER FAMILY INCOME, defined as the difference between the two (See Mullahy and Sindelar, 1988). By definition, this is jointly determined with personal income and was therefore omitted as a possible explanatory variable.

Age

AGE was reported as age at last birthday (prior to the survey interview). Age, controlling for other factors explaining income, is expected to have a positive, but, after some point, declining effect on income. This is a standard hypothesis and is usually estimated by including both an age and age-squared (AGE^2) variable on the right-hand side of the income equation. In this study, because of the high degree of collinearity between age and age-squared

variables, and the resulting difficulty of the maximum likelihood estimation procedure to converge, an alternative approach was taken to the specification of the same concave (from below) relationship.

A linearized version of the standard quadratic relationship was used. Three sets of variables representing age were introduced: 1) age, in years; 2) dummy variables for each of the four age groups (18-24, 25-34, 35-54, 55-64); and 3) interaction terms between age and the age group dummies. Because the four age groups are mutually exclusive, one age group must be excluded from the specification in order for the estimation to be possible. The youngest age group (18-24) was taken as the excluded age group. For each sample individual, therefore, measures of the following seven variables were included in the income equation:

AGE	in years
AGEGROUP2	1 if 25-34; 0 otherwise
AGEGROUP3	1 if 35-54; 0 otherwise
AGEGROUP4	1 if 55-64; 0 otherwise
AGE * AGEGROUP2	AGE, if Group 2; 0 otherwise
AGE * AGEGROUP3	AGE, if Group 3; 0 otherwise
AGE * AGEGROUP4	AGE, if Group 4; 0 otherwise.

The coefficient on AGE is still the expected positive first-order effect of age on (the natural logarithm of) income. Coefficients on AGEGROUP_i (i=2, 3, or 4) and AGE*AGEGROUP_i represent the linearized quadratic relationship between age and income, giving that relationship its concave shape. Coefficients on AGEGROUP_i may be positive or negative and represent shifts in the equation intercept. Coefficients on AGE*AGEGROUP_i are expected to be negative. (Sample individuals in AGEGROUP1 are uniquely represented by having zero values for the last six of the above seven variables.)

Race

RACE was reported as non-Hispanic black, non-Hispanic white, Hispanic, American Indian, Alaskan Native, Asian, Pacific Island and other. This variable was recoded to four mutually exclusive, dichotomous variables: white, black (BRACE), Hispanic (HRACE) and other (ORACE). The latter three were included in the regression equation, their coefficients signifying the income displacement of non-white races relative to the income level of whites. All three coefficients are expected to be negative.

It should be noted that RACE is the only information in the ECA Public Use Data Set which relates to the circumstances of respondent's family of origin. No information is available on the income, education, or occupation of parents (Data sets retained at each of the ECA survey sites, however, do contain this important information).

Marital Status

Marital status was defined in this analysis as a dichotomous variable with a value of one for those reporting to be either presently married or "currently living with someone as though . . . married". Marital status is expected to be positively related to income for men and negatively for women, since married

women, particularly in the older working-age age groups, are less likely to be labor force participants.

Children

Respondents were asked how many children they had. One site included adopted and foster children. The rest did not, although one site only asked this question of women (for men, this measure had a missing value). The range of values for this variable was from 1 to 21. It was recoded for this analysis so that the variable KIDS took a maximum value of 7. For reasons similar to those underlying the hypotheses about marital status, KIDS is expected to exert a positive influence on the income of men and a negative one on that of women.

Illness

Respondents were asked if they have been physically "sickly for the majority of [their] life." This variable was used as a dichotomous human capital indicator of physical health. Sample individuals with positive values of SICK are expected to have lower incomes than those without, controlling for all other measured influences on income.

Measures of ADM Disorders

The ECA data provide diagnostic information on 1) alcohol abuse and dependence; 2) drug abuse and dependence for each of six substances (barbiturates, opioids (heroin), cocaine, amphetamines, hallucinogens, and cannabis (marijuana)), as well as a summary measure of the six, considering each equally disordered; and 3) psychiatric illnesses for each of 12 psychiatric diagnoses (elaborated below). For each of the conditions (with a few exceptions) there are lifetime diagnoses (ever satisfied criteria for DSM-III diagnosis), onset measures (age of earliest problems in individuals with a given lifetime diagnosis), and recency measures (age of most recent symptoms).

Severity criteria for the drug and psychiatric disorders allow for the construction of indicators with different degrees of severity. Exclusion criteria permit the exclusion of certain diagnoses if other comorbid diagnoses have been given. The construction of prevalence measures in this study follows the convention of previous investigators of the ECA survey data in generally ignoring both severity and exclusion criteria. (Regier et al., 1988; Robins et al., 1984; Kessler et al., 1987). Relatively minor exceptions to this convention are the exclusion of cases of major depression occasioned by grief alone and adherence to the exclusion criteria attached to anti-social personality. An important exception is the case of drug abuse or dependence in which only diagnoses meeting the severity condition are counted, explained below.

Alcohol Abuse

Respondents are given a diagnosis of alcohol abuse if their responses to DIS questions fulfill the criteria for pathological use and impairment in social or occupational functioning. They are given a diagnosis of dependence if they fulfill only one of the above and the criteria for tolerance or withdrawal.

Of the 18,562 individuals in the survey for whom age was known, there were 2,088 with a lifetime diagnosis of alcohol abuse or dependence (or both),

but only 295 were dependent without abuse. Almost exactly half, 1,053, satisfied the criteria for both abuse and dependence.

The basic alcohol variable (DSMALC in the ECA coding) was therefore used to construct a lifetime diagnosis of either abuse or dependence. That is, a dichotomous lifetime prevalence variable, ALC, was constructed, taking a value of one if the individual ever had a diagnosis of either dependence or abuse of alcohol, and zero otherwise.

Drug Abuse

In the present study, problems associated with separate drugs were investigated in the exploratory phase but the results were ill-defined; results reported, therefore, are based only on research involving the summary drug information provided, covering cannabis, opioids, cocaine, hallucinogens, barbiturates, and stimulants. The summary ECA measure (DMDRGSUM) provides indicators for all combinations of abuse, dependence and severity, where severity is met by indications of help-seeking or "interference with life."

Positive help-seeking is indicated by having mentioned a drug problem to a doctor or other professional (not necessarily having sought them out for that purpose) or having taken a medication more than once for a drug problem. "Interference with life" is indicated by a positive response to the question, "Did any of these problems with drugs interfere with your life or activities a lot?" Abuse and dependence definitions were similar to those for alcohol.

Various dichotomous lifetime prevalence indicators were constructed from the ECA summary measure (DMDRGSUM). These include DRGAD, drug abuse or dependence whether or not meeting severity requirement; DRGSEV, abuse or dependence meeting severity requirement; DRGMIL, abuse or dependence not meeting severity requirement (mild), as well as similar variations for abuse or dependence alone. Of the 18,562 respondents with ages given, 877 were DRGAD positives and 377, DRGSEV positives. Because a statistical relationship could only be found between income and DRGSEV, from among the possible drug diagnosis variables, DRGSEV was used as the drug involvement indicator.

Mental Illness

Separate diagnostic information is provided for each of the following psychiatric disorders: cognitive impairment, mania, major depression, dysthymia, schizophrenia, schizophreniform disorder, obsessive-compulsive disorder, phobia, somatization, panic disorder, antisocial personality, and anorexia.

Although the above list covers many of the most important disorders, it omits a large number of potentially income-compromising disorders, particularly a large number of personality disorders, described by the American Psychiatric Association (1980). DSM-III diagnoses (ignoring severity and exclusion criteria, as described above) of these 12 disorders were grouped into five aggregations (Regier et al., 1988): Schizophrenic Disorders (Schizophrenia and Schizophreniform Disorder); Affective Disorders (Mania, Major Depression, and Dysthymia); Anxiety Disorders (Phobia, Panic Disorder, and Obsessive Compulsive Disorder); Anti-Social Personality; and an "all other" category,

Table B-1

ALCOHOL PREVALENCE RATES FROM THREE SURVEYS BY AGE AND SEX

Prevalence Measure and Age	NAS		NHSDA		ECA	
	Male	Female	Male	Female	Male	Female
ALC						
18-24	38.8%	17.1%	44.9%	28.8%	27.3%	10.0%
25-34	42.9	18.8	43.4	17.0	22.0	4.6
35-54	34.8	11.4	29.7	13.9	28.9	5.1
55-64	27.2	4.1	27.8	6.0	18.6	2.3
ALCAB						
18-24	30.2	15.0	38.0	25.3	25.7	9.3
25-34	36.6	13.5	34.8	13.2	19.2	4.2
35-54	31.8	7.8	21.4	6.9	25.9	4.2
55-64	24.4	3.3	14.2	3.6	15.4	1.8
ALCDEP						
18-24	23.8	11.1	29.1	15.3	12.1	5.2
25-34	24.8	12.9	31.8	10.0	11.5	2.8
35-54	21.5	7.3	21.5	9.8	19.5	3.9
55-64	13.2	3.2	23.0	4.1	13.3	1.8
PD (1984)						
18-24	17.5	5.4				
25-34	21.2	5.3				
35-54	15.5	4.4				
55-64	10.4	0.1				
PD (1979)						
18-19	16.4	5.7				
20-24	21.0	15.4				
25-34	18.5	4.5				
35-44	11.9	8.2				
45-54	13.3	5.6				
55-64	6.0	0.8				

NAS - National Alcohol Survey.

NHSDA - National Household Survey on Drug Abuse.

ECA - Epidemiologic Catchment Area Surveys.

SOURCES: UCSF calculations from 1984 NAS, 1985 NHSDA and 1980-84 ECA Surveys.
RTI calculations from 1979 NAS Survey (Harwood et al., 1984).

denoted as SOMCOGA, including Somatization and Cognitive Impairment, both with very low prevalence rates.

Other Measures

Because the survey took place over a five-year period (1980-1984) in four locations (excluding St. Louis), the estimation of an income equation required some control for this design. Therefore, dichotomous variables for each year and location in the analysis were used as controls on the overall macroeconomic level of personal income from one year to the next as well as systematic and stratification differences in income from one location to another.

In all, there are seven such mutually-exclusive, time-location variables:

TLYO	New Haven (Yale), 1980
TLY1	New Haven (Yale), 1981
TLH1	Baltimore (Hopkins), 1981
TLD2	Durham (Duke), 1982
TLD3	Durham (Duke), 1983
TLL3	Los Angeles (UCLA), 1983
TLL4	Los Angeles (UCLA), 1984.

Because these seven are mutually exclusive, one must be excluded from the equation specification. TLL4 was taken as the excluded variable. Coefficients on the six remaining variables are to be interpreted as the displacement in income in the respective years and locations, relative to those surveyed in Los Angeles in 1984. Coefficients on all six included variables are expected to be negative for a combination of two reasons: first, incomes generally rise over time; and second, the Los Angeles locale surveyed in 1984 is a wealthy (West Los Angeles) district.

PREVALENCE: THE MEASUREMENT OF ADM DISORDERS

A central issue in the measurement of income losses due to ADM disorders is the actual form in which ADM disorders are defined and employed in the analysis. The various forms in which prevalence rates have been defined and measured, the form used in this study, and a comparison of empirical rates used in this study with those of other studies and surveys are described below. The use and adaptation of prevalence rates in this study are elaborated to include the issues of overlap and timing of ADM disorders.

Problem vs. Quantity-Frequency vs. Diagnostic Measures

Prevalence of individual ADM disorders is generally measured in one of three ways. The first type of prevalence measure is a Problem Measure. Harwood and associates (1984) use a problem measure of the prevalence of alcohol abuse, denoted by problem drinking (PD). This PD measure is a dichotomous variable taking on the value of one if the sample individual answers affirmatively to any of the following four questions:

Table B-2

DRUG PREVALENCE RATES FROM TWO NATIONAL SURVEYS BY AGE AND SEX

<u>Disorder and Age</u>	<u>NHSDA</u>		<u>ECA</u>	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
DRG				
18-24	14.5%	10.6%	21.2%	15.8%
25-34	12.9	7.1	13.3	7.1
35-54	2.3	1.5	6.1	2.8
55-64	0.5	0.0	0.0	0.4
DRGSEV				
18-24	1.4	1.3	8.6	6.7
25-34	1.7	1.2	5.6	3.4
35-54	0.1	0.1	2.7	1.9
55-64	0.0	0.0	0.0	0.4
DRGAB				
18-24			17.7	12.6
25-34			9.2	5.2
35-54			3.7	2.0
55-64			0.0	0.3
DRGDEP				
18-24			10.4	8.2
25-34			8.2	4.0
35-54			3.8	1.7
55-64			0.0	0.4
MJ (1982)				
18-19	18.9	14.3		
20-24	21.8	11.0		
25-34	12.5	4.5		
35-44	0.0	0.0		
45-54	0.0	0.0		
55-64	0.0	0.0		

NHSDA - National Household Survey on Drug Abuse.

ECA - Epidemiologic Catchment Area Surveys.

SOURCES: UCSF calculations from 1985 NHSDA and 1980-84 ECA Surveys.
RTI calculations from 1982 NHSDA Survey.

- Ever late to or miss work because of a hangover?
- Have problems with spouse or ex-spouse in the past year because of drinking?
- Ever arrested for driving while under the influence of alcohol?
- Have you gone on a drinking binge in the last 12 months?

The prevalence *rate*, as measured by PD is then the number of individuals in the sample or population who answer affirmatively to any of the above questions, divided by the corresponding total population.

A second type of prevalence measure is a Quantity-Frequency measure, applicable only to cases of substance abuse. This is a measure of the quantity of the substance consumed per unit of time over some part of the individual's lifetime. Harwood and associates (1984) use such a measure for the prevalence of drug abuse and as a control variable on the prevalence measure of alcohol abuse described above. In the RTI study the prevalence of drug abuse is defined as a dichotomous variable, taking the value of one for individuals with daily marijuana use for a month or longer at some point over their lifetime. The alcohol control variable is defined as absolute ounces of daily alcohol intake. Prevalence rates are defined accordingly.

A third type of prevalence measure is a Diagnostic measure, defined in terms of individuals satisfying the clinical criteria for a medical diagnosis of alcohol abuse or dependence, drug abuse or dependence, or some category of mental illness. Previous surveys have generally not been able to avail themselves of diagnostic measures, since the cost of rendering medical diagnoses in a survey format has heretofore been prohibitive. With the development of the Diagnostic Interview Schedule (DIS) during the 1970s, this barrier was overcome (Robins, 1985). In the ECA survey, the DIS is administered to survey respondents by lay interviewers, resulting in a database which, through computer analysis, is translated into medical diagnoses, according to DSM-III criteria (American Psychiatric Association, 1980).

Comparison of Prevalence Rates by Survey and Type of Measure

An obvious question is that of the correspondence of prevalence rates for the same disorders, measured in these three different ways. The reliability question is that of the similarity of measured prevalence rates. The validity question is that of the degree to which the same individuals would be determined to be prevalent where different prevalence measures are applied to the same sample group.

Tables B-1 and B-2 show comparisons of prevalence rates for various alcohol- and drug-related prevalence measures across surveys and over time. In Table B-1, various alcohol measures are compared from three surveys, the 1984 NAS survey, the 1985 NHSDA survey and the 1980-84 ECA survey. In all cases, these rates are based on the application of national weights to individual cases, where the weights are inversely proportional to the representation of sample individuals in the national population, by sex and race.

The first three prevalence measures reported in Table B-1 are DSM-III diagnoses of alcohol abuse or dependence (ALC), alcohol abuse (ALCAB), and alcohol dependence (ALCDEP). ECA values for these rates are taken directly

from the ECA data. Algorithms were developed to attempt to match the diagnostic rules used in the ECA diagnoses to the data in the NAS and NHSDA surveys. The problem was that there is not a perfect correspondence between the questions asked in the ECA survey and those of the other two surveys. As a result, the "crosswalked" rates obtained from the NAS and NHSDA surveys are considerably higher than those found in the ECA survey and considerably higher than the PD values found in the last two NAS surveys.

In the lower portion of Table B-1 are the rates reported by Harwood and associates (1984, p. A-13) for the variable PD, based on the 1979 NAS survey. These correspond closely to the measure of PD reported in the upper part of the table based on the 1984 NAS survey. Moreover, the ALC rates obtained from the ECA survey are higher than, but comparable to, the PD rates obtained from the two NAS surveys.

Table B-2 presents similar comparisons for drug measures. The first four measures are diagnostic measures available in the ECA data. In the lower part of the table are presented the prevalence rates for MJ, lifetime daily marijuana use for a month or more, as reported by Harwood and associates (1984: p. A-13).

DRG, the first variable listed in Table B-2, is a measure of the prevalence of persons having a medical diagnosis of either drug abuse or dependence, without regard to severity. These rates are very close to those shown in the lower part of the table, representing MJ. It should be noted, however, that MJ represents marijuana use alone, whereas DRG encompasses all forms of drug use queried in the ECA surveys. The "crosswalked" measures of DRG obtained from the 1985 NHSDA survey are lower than, but comparable to, those from the ECA survey. Because of a change in questions from the 1982 to the 1985 NHSDA survey, a comparable measure of MJ could not be calculated for 1985.

The second variable in Table B-2, DRGSEV, is a measure of the prevalence of drug abuse or dependence, in which all cases meet the severity condition (See above for a description of the severity condition). For DRGSEV, prevalence rates obtained from the ECA survey are less than half those of DRG, whereas the "crosswalked" rates for DRGSEV obtained from the NHSDA survey are small. For illustrative purposes, ECA values for DRGAB and DRGDEP are also shown.

Prevalence rates for ALC and DRGSEV, taken from the ECA survey, and shown in Tables B-1 and B-2, are the same as those shown in Table 37 in Chapter IV. Prevalence rates for mental illnesses also appear in Table 37.

Treatment of the Overlap of ADM Disorders

It is well known that ADM disorders are not neatly segregated among prevalent individuals. Drug abusers often abuse alcohol and vice versa, and both types of substance abusers have higher than average rates of mental illness (Rachal et al., 1981, 1982; Miller et al., 1983; Collins and Schlenger, 1983; Grande et al., 1984; Wolf et al., 1988).

In a study that distributes all income losses due to ADM disorders among the three categories, the prevalence of multiple disorders in individuals presents a unique problem -- namely, how to allocate income loss attributable to multiple disorders among the disorders. This problem was addressed by first determining if measurable interaction effects of overlapping disorders were

identifiable. In initial regression studies, AD, AM, DM, and ADM variables were included, along with A, D, and M, to determine if overlapping prevalence introduced additional income loss (over and above that found from first-order prevalence measures). Because of the collinearity introduced by these additional variables, however, it was not possible to statistically discern such effects.

As a result, the following analysis assumes that the effects of overlapping prevalence are additive, but not interactive. In other words, the impairment rate found for drug abuse is the same whether it is a sole disorder or in the presence of an alcohol and/or a mental disorder. Additive effects are found by including the separate disorder variables in regression equations in the usual additive way.

Timing Considerations in the Measurement of ADM Disorders

Previous studies of ADM-related income loss have generally used simple dichotomous measures of lifetime prevalence, despite the obvious fact that disorders within individual lives occur with different recency, severity, and duration. Losses estimated in these studies are the average differences between the incomes of people with and without dichotomously measured disorders, controlling for other variables. Estimates based on dichotomous measures of prevalence are presented below for comparative purposes. They are referred to as the Indicator Model results.

The analysis pursued in this study is motivated by an effort to more closely relate variations in personal ADM disorder histories to income loss, in contrast to measures of loss based on dichotomous measures. Three different models of the behavioral translation of ADM disorders into impairment are hypothesized, specified, and estimated. The three models result in differently specified relationships between percentage reductions in income and functions of age at onset and age at remission or interview (if there is no remission). Because these specifications are of temporal attributes of ADM disorders, their estimates are referred to below as the Timing Model results.

There are some similarities in the models: 1) ADM-based income losses are assumed to have occurred only to individuals with lifetime ADM (DSM-III) diagnoses; 2) none of the models takes account of variations that may exist in the severity of ADM disorders; and 3) because the ECA data did not identify periods of remission surrounded by periods of disorder, ADM disorder-induced income losses are assumed to arise from a constant process occurring between time of onset and time of last symptom or interview (if the respondent was not in remission at the time of the ECA interview).

The differences between the three models focus on the description of the instantaneous process translating ADM disorders into income loss over time, and on what happens to this process in remission. Greater detail on the models is provided in Appendix C.

Model 1

In the first model, a short period of disorder is assumed to immediately reduce productivity, causing a small immediate percentage loss in income. Under the assumptions of this first model, percentage loss in current income is expressed as the product of an ADM-specific constant and the duration an individual has the ADM disorder. The constant represents the product of the

Table B-3

REGRESSION COEFFICIENTS FOR CONTROL VARIABLES* BY MODEL AND SEX
Coefficient/(t value)

Variable	Timing Model		Indicator Model	
	Male	Female	Male	Female
Intercept	3.78 (11.31)	3.28 (8.41)	3.89 (11.91)	3.32 (8.59)
AGE	0.25 (15.60)	0.26 (14.31)	0.24 (15.54)	0.26 (14.24)
AGEGROUP2	4.66 (10.84)	6.13 (12.20)	4.60 (10.89)	6.07 (12.17)
AGEGROUP3	6.71 (17.80)	6.96 (16.08)	6.50 (17.64)	6.91 (16.02)
AGEGROUP4	8.35 (10.30)	7.45 (8.84)	8.13 (10.20)	7.36 (8.82)
AGE*AGEGROUP2	-0.20 (-10.90)	-0.25 (-11.85)	-0.20 (-10.95)	-0.25 (-11.84)
AGE*AGEGROUP3	-0.26 (-15.83)	-0.27 (-14.58)	-0.25 (-15.76)	-0.27 (-14.55)
AGE*AGEGROUP4	-0.28 (-14.19)	-0.28 (-12.60)	-0.28 (-14.16)	-0.28 (-12.57)
MAR	0.38 (11.66)	-0.46 (-12.22)	0.38 (11.72)	-0.44 (-11.77)
KIDS	0.0084 (0.84)	-0.10 (-11.58)	0.0077 (0.78)	-0.10 (-11.49)
HRACE	-0.51 (-9.77)	-0.62 (-10.41)	-0.47 (-8.97)	-0.59 (-9.83)
BRACE	-0.45 (-11.63)	0.025 (0.54)	-0.41 (-10.75)	0.048 (1.05)
ORACE	-0.48 (-7.21)	-0.12 (-1.46)	-0.47 (-7.31)	-0.13 (-1.49)
SICK	-0.62 (-7.21)	-0.45 (-5.37)	-0.64 (-7.78)	-0.46 (-5.56)
TLY0	-0.51 (-8.94)	-0.82 (-10.79)	-0.49 (-8.62)	-0.79 (-10.49)
TLY1	-0.52 (-7.11)	-0.70 (-7.55)	-0.51 (-7.09)	-0.68 (-7.43)
TLH1	-0.53 (-8.55)	-0.84 (-10.72)	-0.46 (-7.56)	-0.78 (-9.96)
TLD2	-0.57 (-9.49)	-0.53 (-6.66)	-0.53 (-8.93)	-0.49 (-6.19)
TLD3	-0.51 (-6.00)	-0.31 (-2.54)	-0.48 (-5.60)	-0.27 (-2.26)
TLL3	-0.17 (-2.87)	-0.13 (-1.81)	-0.15 (-2.56)	-0.12 (-1.69)

* Parameter estimates of the reduced form income equation.

average intensity of the disorder and the way the particular ADM disorder is translated into percentage earnings loss. (This constant is estimated by regressing the natural logarithm of personal income on the timing measures of disorder and other control variables.) If the individual is in remission at interview, the timing measure (disorder duration) is the time between first onset and last symptom. If the individual is not in remission at interview, the timing measure is the time between first onset and interview. In either case, the timing measures presented below are age-sex specific averages of the duration of the disorder process among the prevalent sample population.

Model 2

In the second model, a short period of disorder is again assumed to immediately reduce productivity, causing a small immediate percentage loss in income, as it did in the first model. But the effects of a particular short period of disorder continue to reduce productivity into the future, resulting in future income losses, which are occurring at exponentially declining rates. In effect, the economic system has a memory of past events, but one in which time heals, and less productivity loss is attributed to difficulties from past disorders. Under these assumptions, the effects of particular past periods of disorder are diminishing, but because the present effect on income is the accumulation of all past and present ADM-related disorders, it is increasing in absolute size over time.

A further implication of the second model is that at the point of remission there is an immediate cessation of the effects of past disorders on percentage reductions in current income. The cumulative effects of lifetime disorders on current income, again the sum of these small percentage losses, results in a more complicated expression than that found for the first model. Here, an exponential function of the rate of recovery and the duration of the debilitation process is found. Power series methods are used to create an order 3 approximation for this expression, which simplifies to the desired linear form: the product of an ADM-specific constant and the square of the lifetime duration of the disorder. For the second model, the timing measures given below are the age-sex specific averages of the square of durations of an individual's ADM disorders.

Model 3

The third model, adapted from Chiang and Conforti (1989), is exactly like the second, except for the feature describing what happens in remission. The third model is less forgiving; in remission, new disorder effects are no longer added, but the effects from past disorders are still experienced at their exponentially declining rates. The model again yields a complicated exponential expression, which is simplified, as in Model 2, into a linear form. The resulting expression is the product of a constant and the difference between the square of the duration since onset and the square of the duration since last symptom. Note that if the disorder persists at interview, Model 3 reduces to Model 2: the last term in the timing measure of Model 3 becomes zero. For the third model, the timing measures below are age-sex specific averages of the difference between the square of the time since onset and the square of the time since last symptom.

In the analysis, equations were estimated using each of the three timing models for each of the disorders studied. A final equation was then run, using,

Table B-4

TIMING MEASURES OF ADM DISORDERS BY AGE AND SEX

<u>Disorder*</u> <u>and Age</u>	<u>Male</u>	<u>Female</u>	<u>Disorder</u> <u>and Age</u>	<u>Male</u>	<u>Female</u>
ALC	Model 1	Model 2	AFF	Model 1	Model 1
18-24	3.56	13.54	18-24	4.69	4.61
25-34	7.56	44.92	25-34	6.37	7.60
35-54	13.88	204.50	35-54	13.13	12.42
55-64	24.03	332.40	55-64	25.46	20.65
DRGSEV	Model 3	Model 3	ANX	Model 3	Model 3
18-24	32.48	18.55	18-24	182.60	165.40
25-34	77.63	83.25	25-34	380.90	372.70
35-54	257.50	129.10	35-54	976.90	942.10
55-64	0.00	526.90	55-64	1,478.00	2,040.00
SCHIZ	Model 3	Model 1	ASP	Model 1	Model 1
18-24	133.20	5.82	18-24	11.82	11.36
25-34	155.70	11.77	25-34	17.95	17.34
35-54	631.70	16.97	35-54	27.09	30.72
55-64	2,657.00	27.47	55-64	40.69	44.76

Timing Measure Expressions:

Model 1: Minimum [A-tb, te-tb].

Model 2: Minimum [(A-tb)², (te-tb)²].

Model 3: (A - tb)² - (A - te)², for A > tb and A > te.

where: A is the time of interview; tb is the time of onset of disorder, and te is the time of last symptom of disorder.

* Each entry represents the average value, by age, sex and disorder, of the power series approximation of the degree of clinical impairment among prevalent individuals, specific to the particular Timing Model used (1, 2, or 3). All timing measures are expressed in units of years or years squared, and represent measures of clinical impairment, not duration of time. Timing measures not estimated for SOMCOGA.

for each disorder, the model the model with the highest significance level for its parameter estimate.

ESTIMATION OF THE PARAMETERS OF THE MODEL

Regression equations of the natural logarithm of personal income on control and disorder variables were estimated separately by sex. The Grouped Data option of the mainframe version of LIMDEP software (Greene, 1986) was employed in the estimation. Individual cases were weighted by sampling weights provided in the ECA data tape.

Control Variables

Control variables were composed of first- and second-order age variables, marital status, number of children, three mutually exclusive race variables, a physical health status variable, and the year-and-location-of-survey variables. Disorder variables were timing measures of the lifetime diagnoses described above: ALC (alcohol abuse or dependence), DRGSEV (drug abuse or dependence, meeting the severity criteria), SCHIZ (schizophrenic disorders), AFF (affective disorders), ANX (anxiety disorders), ASP (anti-social personality), and SOMCOGA (somatization and cognitive impairment). The timing analysis was not conducted on SOMCOGA.

Tables B-3 to B-7 present the results of the regression analysis of ADM-associated income loss. These Tables present the results for both the timing model and for the indicator model. Coefficients for both control and ADM variables are presented.

Table B-3 presents the regression coefficients for control variables in both models. Because the difference between the two models only concerns the disorder variables, it is not surprising that the values and statistical significance of the control variables are very similar. For interpretations of the actual values of the coefficients, it should be remembered that they are exponents (since the dependent variable is a logarithm).

The age variables demonstrate the expected signs, with the first-order variables positive and the second-order variables negative, suggesting that after some age income, controlling for everything else, begins to decline. Marital status, as expected, is strongly positive for males and equally strongly negative for females. The number of children appears to bear no relationship to the incomes of men, but has a strong negative effect on that of women.

Race generally has the expected effects. For men in the included races (non-white), incomes are approximately 40 percent below those of whites. For women, however, while this pattern persists in the case of Hispanics, there is no statistically discernible difference between black and white incomes, and for "other" races there is a marginally significant difference of approximately 11 percent.

Being "sick all one's life" has a very substantial effect on income, lowering that of men and women by about 50 and 35 percent, respectively. The time and location of survey variables also have the expected signs and values. The signs are all negative, confirming that the incomes of people interviewed in West Los

Table B-5

ADM REGRESSION COEFFICIENTS* BY DISORDER AND SEX,
TIMING MODEL

<u>Disorder</u>	Regression Coefficients* (t-value)	
	<u>Male</u>	<u>Female</u>
ALC	-4.07E-03 (-1.814)	-6.21E-04 (-1.737)
DRGSEV	-3.36E-04 (-0.881)	1.34E-04 (0.124)
SCHIZ	-5.57E-04 (-4.550)	-5.83E-03 (-0.775)
AFF	2.03E-03 (0.464)	2.02E-03 (0.503)
ANX	-6.60E-05 (-1.732)	-6.36E-05 (-2.005)
ASP	-2.38E-03 (-1.219)	-1.46E-04 (-0.034)
SOMCOGA	-0.11 (-0.604)	(-0.466) (-2.642)

* Parameter estimates of the reduced form income equation.

Table B-6

ADM REGRESSION COEFFICIENTS BY DISORDER AND SEX, INDICATOR MODEL

<u>Disorder</u>	Regression Coefficients* (t-value)	
	<u>Male</u>	<u>Female</u>
ALC	-0.103 (-2.926)	-0.075 (-0.943)
DRGSEV	-0.076 (-0.973)	0.141 (1.216)
SCHIZ	-0.508 (-5.114)	-0.245 (-2.057)
AFF	0.339 (9.247)	0.271 (6.289)
ANX	-0.106 (-2.639)	-0.188 (-4.744)
ASP	-0.042 (-0.835)	-0.108 (-1.036)
SOMCOGA	-0.099 (-0.563)	-0.477 (-2.734)

* Parameter estimates of the reduced form income equation.

Table B-7

ESTIMATES OF ADM INCOME EFFECTS,
TIMING MODEL VS. INDICATOR MODEL*

<u>Disorder</u>	<u>Regression Coefficients</u>		<u>Impairment Rates</u>	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
ALC	-0.103	-0.075	-9.8%	-7.1%
18-24	-0.014	-0.008	-1.4	-0.8
25-34	-0.031	-0.028	-3.0	-2.8
35-54	-0.056	-0.127	-5.5	-11.9
55-64	-0.098	-0.206	-9.3	-18.7
DRGSEV	-0.076	0.141	-7.3	15.1
18-24	-0.011	0.002	-1.1	0.2
25-34	-0.026	0.011	-2.6	1.1
35-54	-0.087	0.017	-8.3	1.8
55-64	0.000	0.071	0.0	7.3
SCHIZ	-0.508	-0.245	-39.8	-21.7
18-24	-0.074	-0.034	-7.2	-3.3
25-34	-0.087	-0.069	-8.3	-6.6
35-54	-0.352	-0.099	-29.7	-9.4
55-64	-1.480	-0.160	-77.2	-14.8
AFF	0.339	0.271	40.4	31.1
18-24	0.010	0.009	1.0	0.9
25-34	0.013	0.015	1.3	1.5
35-54	0.027	0.025	2.7	2.5
55-64	0.052	0.042	5.3	4.3
ANX	-0.106	-0.188	-10.1	-17.1
18-24	-0.012	-0.011	-1.2	-1.0
25-34	-0.025	-0.024	-2.5	-2.4
35-54	-0.064	-0.060	-6.2	-5.8
55-64	-0.098	-0.130	-9.3	-12.2
ASP	-0.042	-0.108	-4.1	-10.2
18-24	-0.028	-0.002	-2.8	-0.2
25-34	-0.043	-0.003	-4.2	-0.3
35-54	-0.064	-0.004	-6.2	-0.4
55-64	-0.097	-0.007	-9.2	-0.7
SOMCOGA	-0.099	-0.477	-9.5	-37.9

* Coefficients opposite disorder label are Indicator Model estimates; those opposite age groups are Timing Model estimates. Timing measures are not estimated for SOMCOGA. Impairment rates are coefficients adjusted by the transformation, $\text{antiln}(\text{coeff}) - 1$.

Angeles in 1984 are higher than those of everyone else interviewed earlier in the ECA survey, controlling for all other effects. The absolute values of the coefficients generally decline for more recent interviews, although this is not without exception, particularly for men. In part, this reflects the effects of the recession of 1982.

Disorder Variables

In the timing model, the disorder variables are a measure of the duration and recency of the disorder, where the measure used depends on the particular timing model best characterizing the particular disorder. Average values of the timing measures among disordered individuals for each disorder are given by age group in Table B-4. Table B-4 also shows the specific timing model used for each sex and disorder. Table B-5 gives the resulting regression coefficients. Table B-6 shows the corresponding statistical results of disorder variables obtained from the indicator model. Loss ratios by age group, as shown in Table B-7, are derived by multiplying the regression coefficients (from Table B-5) by the timing measures (from Table B-4).

Impairment rates were then obtained by performing the antilog transformation on the loss ratios, as also shown in Table B-7. Indicator model impairment rates are also shown in Table B-7 for comparison.

As is evident from Table B-7, impairment rates derived from the timing model are lower than those from the indicator model. Because the timing model more closely represents the clinical life history of the disease, impairment, and recovery processes, the results are considered more accurate than those obtained from the indicator model.

Comparing the results in Tables B-5 and B-6, the coefficients are not uniformly statistically robust in either model. In the timing model, the alcohol coefficients for both male and female equations are moderately significant for a one-tail test. In the indicator model, the male coefficient is much stronger and the female much weaker. In both models, the drug coefficients are extremely weak, though negative, for men and positive and insignificant for women.

In the indicator model, the effect of schizophrenic disorders is large and strong for both men and women, whereas in the timing model it remains strong for men, but, while negative, is insignificant for women. Affective disorders show a very large and strong positive influence on income in the indicator model, but the statistical significance of affective disorders virtually disappears in the timing model. The statistical significance of anxiety disorders is strong in the indicator model and moderate in the timing model. Antisocial personality is weak in both models and the effect of SOMCOGA, the combined somatization and cognitive impairment category, remains largely unchanged, since a timing measure was not used for this variable.

Turning to Table B-7 and focusing on the timing model results, male alcohol impairment rates rise from 1.4 percent for those aged 18-24 to over 9 percent for those aged 55-64. For women, the corresponding rates rise from 1 percent to over 18 percent for the same ages. For drug impairment, male rates rise from 1 percent to over 8 percent in the 35-54 age group. Female drug impairment rates were positive, albeit insignificant; these positive rates were not used in the calculation of income loss in Chapter IV. Instead, an imputation was

made as described below. Not surprisingly, schizophrenic disorders showed the largest impairment, rising from 7 to 77 percent for men and from 3 to 15 percent for women.

Affective disorders were found in the indicator model to be strongly associated with a large positive influence on income. This finding was severely reduced in the timing model, however. As argued in Chapter IV, we do not accept the implication that, all other things equal, having an affective disorder diagnosis increases one's income. Rather, we conclude that the selection bias problem is particularly pronounced for the case of affective disorders. Whether this results from the socioeconomic distribution of affective disorders, or from the greater responsiveness of higher income individuals to DIS questions yielding affective disorder diagnoses, cannot be determined from this analysis. As a result, the findings on affective disorders were not used in the income loss calculations.

Impairment rates due to anxiety disorders rose from 1 to 9 percent in men and from 1 to 12 percent in women. Those due to anti-social personality rose from 3 to 9 percent in men and were under 1 percent for women. The aggregate measure of somatization and cognitive impairment, finally, yielded (without timing) impairment rates of 10 and 37 percent for men and women, respectively, across all ages. These results are the same as those shown in Table 40, which form the basis of the income loss calculations for the civilian noninstitutionalized resident population reported in Table 41.

Two imputations for drug losses have been added in the final results. No usable impairment rates were obtained from the regression analysis for women and for men aged 55-64. For women, positive or negligible results were obtained from the regression analysis. Imputations based on alcohol impairment rates were used. For men aged 55-64, there were no prevalent cases in the ECA survey sample. Therefore, an imputed aggregate loss was estimated based on the ratio of income loss due to alcohol abuse for the 55-64 age group divided by that for the 35-54 age group. This ratio was applied to income losses due to drug abuse for the 35-54 age group, resulting in an additional loss of over \$600 million.

For women, the regression results for drug abuse presented the same problem as those for affective disorders and were therefore unusable. Imputations were made by multiplying the ratio of female to male alcohol impairment rates, by age, by the male drug impairment rates. This resulted in an additional loss due to drug abuse of \$2.4 billion. Both of these imputations are somewhat arbitrary, but likely more accurate than leaving them at zero.

DISCUSSION OF RESULTS

Losses due to the prevalence of ADM disorders are measures of productive impairment rates among affected individuals. This investigation has introduced a number of innovations in the measurement of income loss due to ADM disorders. Among these are use of the ECA survey and:

- 1) Simultaneous estimation of losses due to all three classes of ADM disorders;
- 2) Explicit accounting for the overlap of ADM disorders;

- 3) Consideration of the timing of the disorders within the lifetimes of prevalent individuals;
- 4) Use of personal income rather than household income as the dependent variable; and
- 5) Estimation based on grouped data, maximum likelihood method procedures.

These innovations have resulted in significantly lower estimates of loss than those previously reported by RTI. Discussion of these differences is contained in Chapter IX. Impairment rates remain, in many cases, poorly resolved. The problem of the joint dependency of prevalence rates and income continues to shadow the estimates. It probably underlies the findings of positive income relationships with drugs (for women) and affective disorders for both sexes. The problem may also underlie the negative estimates found for other disorders.

APPENDIX C

TIMING MODEL USED IN ESTIMATION OF ADM IMPAIRMENT RATES

Knowledge is sought in the present study about the loss in the value of productivity that follows impairments due to alcohol abuse, drug abuse and mental illness (ADM). The problem is to estimate productivity losses causally induced by ADM impairments. Chapter IV reports the estimates of ADM productivity loss and Appendix B elaborates the analytical and statistical development of measures of impairment rates and productivity loss. The purpose of this appendix is to present the detailed methodology used by the authors to address the problem of causally induced impairments.

REVIEW OF THE LITERATURE

An economic analysis of the effects of ADM probably began with Ohlin's analysis of the loss induced by alcohol (Osterberg, 1983). Harwood and associates (1984) cite 11 studies of alcohol-induced losses, 6 of which precede the important Berry and Boland (1977) estimates. Hu and Sandifer (1981) note that Malzberg (1950) and Fein (1958) performed the first productivity loss estimates associated with mental illness.

The human capital paradigm is commonly employed to estimate the losses to productivity associated with various kinds of impairments. The basic assumption is that the value of the full productivity loss caused by ADM disorders is approximated by reductions in personal earnings; the value of output not produced approximates the value of income not earned. The effects of reduced work, labor skill, and motivation on the return to capital and/or the rate of profit are ignored.

Since productivity is approximated by income, estimation of productivity loss requires a model of income loss. In the simplest case, the model is the difference between the average income of a group sharing a common disorder and the average income of a group without the disorder. For the general class of this type of problem, demographic and educational factors are controlled for; and sometimes account is taken of regional factors, the existence of health problems, and the extent of disabilities (Luft, 1975; Bartel and Taubman, 1979; Hartunian, Smart and Thompson, 1981; Salkever, 1985). When the link between a specific disorder and productivity loss is direct and clear, as with spinal cord injuries (Berkowitz, 1985), multiple sclerosis (Inman, 1984), stroke, blindness, paralysis, brain injury, or spina bifida (Mitchell and Butler, 1986), the comparison is reasonable. When the

link is less immediate and less clear, as in the relation between income loss and poor or deteriorating health, or between income loss and ADM disorders, greater elaboration is needed to establish causality.

For health, the attempt to move from a model of association to a model of causation usually takes the form of viewing the problem over time in some way. For example, Bartel and Taubman (1979) incorporate respondents' age at time of occurrence of major disease into their earnings model. Chirikos and Nestel (1985) describe 4 different ten-year longitudinal profiles with health status indicators--continuously healthy, gains over the period, gradual diminutions over the period, and continuously poor. Parnes and Meyer (1971), analyzing longitudinal data, conclude that "the [longitudinal] data permit [one] to be more confident than [one] otherwise could be that poor health is actually a cause of, rather than a mere rationalization for, withdrawal from the labor force."

The Research Triangle Institute's (RTI) estimates of ADM-induced productivity loss are the extant national estimates (Harwood et al., 1984). RTI uses the simple average comparison method, controlling for more factors. To briefly review, RTI's income-loss model specifies a relationship between the natural logarithm of (household) income on the left-hand side (LHS) of an equation, and measures of income-determining characteristics, quantity of alcohol consumed, and indicators of problem drinking or marijuana consumption on the right-hand side (RHS). Because the LHS is expressed as the logarithm of income, an unknown coefficient multiplying an impairment indicator is supposed to represent the average percentage differences in income between the group indicated/not indicated, controlling for personal characteristics and indicators of other impairments. Household surveys provide data; regression analysis is used to estimate the unknown coefficients.

When disability-group membership is indicated in an income model, and when other factors (correlated both with income levels and disability-group membership) are omitted from the specification, the omission influences the estimated income differences between the groups. This is the well-known misspecification problem, and unbiased parameter estimates are not obtained, (Hanushek and Jackson, 1977). For example, if blue-collar life styles lead to greater alcohol consumption levels, and if blue-collar jobs pay less on the average than white-collar jobs, then the coefficient on the problem drinking indicator reflects both loss in income due to alcohol-related disabilities, and lower income due to the correlation between blue-collar income and drinking. In this example, the associative relationship between group status and income level shows a greater difference than the loss caused by an alcohol-related impairment to productivity.

Heien and Pittman (1989) refer to this situation as "the well-known sample selection bias" whose correction requires the incorporation of a term that accounts for the likelihood of a respondent being in the impaired group. As a sample selection problem, the appropriate procedure is to incorporate an indicator of disability-group membership and a measure of the probability of disability-group membership (Heckman, 1974).¹ Whether this is a sample selection problem or, as we describe it, a problem of misspecification, the suggestion of treating the association in the measure so that it comes closer to a causal explanation of productivity loss is reasonable.

A fundamental problem with this approach is that it is probably as difficult to specify the correct model of the likelihood of being in the impaired group as it is to specify a causal model of productivity loss. This difficulty raises doubt about how accurate the adjustment to the income loss model, (Stromsdorfer and Farkas, 1980).

Causal Models of Impairment

An alternative approach is to attempt to model directly the causal relationship between disorder and income loss. This literally means specifying processes that could represent the relationship between impairment and loss, processes about which very little is known. We have experimented with this approach.

A causal model relating ADM disorders to income loss must specify a relationship between an impairing process and income loss. In contrast to the sudden onset of some disorders, ADM disorders lead to the gradual depletion of an individual's level of skills and work effort. The process includes declines in punctuality, consistency, reliability, on-the-job safety; in peer, hierarchical, and customer relations; in judgements rendered; and in quantity and quality of performance provided. In response, firms pay less, assign less responsibility, make fewer investments in the individuals, and dismiss faster (Becker, 1967). A causal model of the impairment process would be intrapersonally focused and based on the temporal history of a person's relation to ADM disorders. As suggested above, there is precedent in the literature on the relationship between poor health and income for such an approach, but the analogy to deteriorating health, rather than poor health, is more appropriate.

This appendix presents the development of the three causal models that were estimated to relate an individual's personal ADM history to their productivity/income loss. Focus here is on the derivation of these models and their simplification into an estimable form. Chapter IV and Appendix B

¹ Actually, Heien and Pittman only incorporate the likelihood of disability group status into their correction of Harwood.

present and compare the results from the estimation. Each model is estimated for each disorder. The model with the highest significance level for each disorder is judged best and incorporated into a final model and estimated. This final model combines the best specification for each of the ADM disorders.

*Model 1: The Effect on Income of a Constant
Rate of Disorder*

We begin with notation. The rate at which an individual engages in a disordered behavior or thought process, hereafter referred to as a rate of disorder, is denoted by δ . For example, δ might represent the quantity of alcohol an individual consumes per unit of time, or the intensity of a psychological dysfunction per unit of time. If the disorder occurs over the interval between t and $t + \Delta$, then the level of the impairment from the ADM disorder process is given by $\delta \Delta$.

In model 1, as in all the models to follow, we assume that engaging in a disorder with a disorder rate δ at time t has an instantaneous effect on an individual's productivity, or potential productivity, that causes an instantaneous reduction in income. The term "potential productivity" is included because, as suggested above, the loss process results in lower wages, employment, and labor force participation. This study does not attempt to disaggregate the impact of disorders into these separate labor market effects, though such a disaggregation is in principle possible.

Denoting income at time t by $Y(t)$, and the instantaneous income change by $dY(t)$, the instantaneous percentage change in income experienced at t is given by $dY(t)/Y(t)$. Ψ represents a constant coefficient translating the effect of an ADM disorder on productivity into the instantaneous percentage income loss occurring at t . Because the disorder causes an impairment to productivity, Ψ is less than zero ($\Psi < 0$). In this first model, the instantaneous income loss is assumed equal to the market translation of the rate of disorder. Equation [1.1] expresses this relation:

$$[1.1] \quad dY(t)/Y(t) = \Psi \delta dt.$$

Note that equation [1.1] describes a process that translates a rate of disorder into an impairment in productivity, which is set equal to an instantaneous reduction in income. All of the loss is immediately experienced in model 1, which is in contrast to the other models developed below.

Representing by a single constant the translation of a rate of disorder into a percentage income loss for individuals at considerably different income levels is a simplification of the economic processes at work. We believe this simplification is reasonable, as an initial effort, because the principal objective of these models is to understand how variation in rates and duration of disorder lead to differently described income losses for people with similarly diagnosed disorder conditions.

We turn now to the total income loss from ADM disorders experienced by an individual from disorder onset to the time they are interviewed. Let t_b denote the time of onset of a disorder process, A denote the time of the interview, and t_e denote the time an individual's disorder ended, if they ceased engaging in the process before the time of interview. The total income loss experienced at time A is the sum of the instantaneous percentage income losses from time of onset to time of interview. These losses occur between t_b and T , the minimum of t_e and A , ($T = \min(t_e, A)$).

An expression for the total income loss experienced at the time of the interview follows from integrating equation [1.1] over the length of time the individual is impaired. Equation [1.2] expresses this relation:

$$[1.2] \quad \ln Y(A) - \ln Y(t_b) = \int_{t_b}^T dY(t)/Y(t) dt.$$

Equation [1.3] evaluates equation [1.2] under the instantaneous loss conditions described by equation [1.1]. Since $\ln Y(t_b)$ is the logarithm of the income of an individual at the onset of the impairment process, and impairments are the only reason for income losses in this model, the LHS of equation [1.3] describes the difference between an individual's actual income at the interview and the income s/he would have if s/he had not experienced the ADM disorders. The RHS of equation [1.3] shows that the percentage income loss occurring at the interview is simply the product of the constants representing the market translation of the rate of disorder, Ψ , the rate of disorder, δ , and the length of time the individual engaged in the disorder process.

$$[1.3] \quad \ln Y(A) - \ln Y(t_b) = \Psi \delta (T - t_b).$$

Model 2: The Effect on Income of a Cumulative Disorder Process That Occurs at a Constant Rate of Disorder.

In model 2, the rate at which an individual engages in disorder is again assumed to be constant and denoted by δ . The productivity losses from an

instantaneous disordered behavior at time t are assumed to occur in the future as well as the present. However, the magnitude of the effect is expected to diminish; time is assumed to heal. The meaning of this is that the further in the future from the time of a disorder, the less effect a particular disorder has on income. Moreover, we also assume that future effects from an instantaneous disorder are only experienced so long as the individual continues to be impaired.

Much of the notation and assumptions developed for model 1 hold here as well. An individual's disorder process causally affects his/her productivity at time t and consequently his/her income at t . The effect of the disorder causes an instantaneous percentage income loss at time t , which is denoted by $dY(t)/Y(t)$. The constant Ψ denotes the market translation of the disorder experienced at t into the instantaneous percentage income loss occurring at t . The situation in which a respondent's disorder has not ended prior to the interview is distinguished from the situation in which the respondent has not stopped the disorder prior to the interview, T is the minimum of t_e and A .

Let τ measure a moment in time when a particular disorder occurs. Let t be some future time relative to τ , ($\tau < t$). The effect on an individual's productivity at time t from the disorder that occurred at τ , at the disorder rate δ , is assumed to be described by equation [2.1]:

$$[2.1] \quad \delta \exp [-v(t - \tau)].$$

The rate the disorder effect diminishes over time is represented by n . It is the exponential recovery rate from the damage to productivity that the disorder at τ causes.

The instantaneous income loss at time t in model 2 is given by the market translation of the disorder experienced at t , which arises from the stream of debilitating behavior between onset, t_b , and t . Equation [2.2] describes the relationship between the instantaneous income loss and the magnitude of the productivity disorder experienced at t :

$$[2.2] \quad dY(t)/Y(t) = \Psi \int_{t_b}^t \delta \exp [-v(t - \tau)] d\tau.$$

The total income loss up to the time of interview (A) is the sum of the instantaneous percentage income losses from onset to the time the individual's disorder ended, T . An expression for the total income loss experienced by the respondent at time A follows from integrating equation

[2.2] over the period of the impairment process. Equation [2.3] expresses this relationship and equation [2.4] evaluates this relationship under the assumptions described by the model:

$$[23] \quad \ln Y(A) - \ln Y(tb) = \Psi \int_{tb}^T \left[\int_{tb}^t \delta \exp[-v(t - \tau)] d\tau \right] dt$$

and

$$[24] \quad \ln Y(A) - \ln Y(tb) = [\Psi \delta / v] \{ (T - tb) + (1/v) [\exp[-v(T - tb)] - 1] \}.$$

To more easily estimate equation [2.4] we transform its RHS into a linear form. Power series methods are used. The well-known and converging power series expansion of order 3 of the exponential expression $\exp[-v z]$ is given by equation [2.5] (Sherwood and Taylor, 1954):

$$[25] \quad \exp[-v z] = 1 - v z + (v^2 z^2)/2 + O[z]^3.$$

Substituting $(T - tb)$ for z , equation [2.4] is simplified to the linear form represented by equation [2.6]:

$$[26] \quad \ln Y(A) - \ln Y(tb) = [\Psi \delta / 2] (T - tb)^2 + O[T - tb]^3.$$

Ignoring the third and higher order terms, note that equation [2.6] shows that the percentage income loss causally induced by the impairment process is a function of the square of the length of time the respondent has engaged in the disorder.

Model 3: The Effect on Income of a Cumulative Disorder Process that Occurs at a Constant Rate of Disorder and Continues Affecting Productivity After the Process Ends.

Model 3 describes a respondent's income loss when the effect of the impairment process on productivity and income functions like Model 2, but continues to reduce productivity beyond the time when the respondent's disorder ends. Model 3 is more likely to apply where employment is based on a thorough consideration of performance during previous employments. Perhaps managerial and professional jobs are appropriate for this model. Models 1 and 2 are more likely to apply where consideration focuses on the physical ability to do work. Perhaps trade jobs are more appropriate for these models. We do not know which process is more reasonable for which types of work and we do not explore this topic in more detail.

The notation and most of the assumptions about model 2 are employed. Model 3 only applies to respondents whose disorders have ceased. The model is adapted from Chiang and Conforti (1989).

In model 3, one portion of individual total productivity and income loss arises while they have the disorder. This part is analogous to the condition where $T = t_e$; that is, $A > t_e$ in equation [2.6] above. Another portion arises as a continuing consequence of having engaged in the process, the period between t_e and A . Equation [3.1] describes the sum of these two portions, and equation [3.2] evaluates the relationship under the assumptions described by the model:

$$[3.1] \quad \ln Y(t) - \ln Y(t_b) = \Psi \left\{ \int_{t_b}^{t_e} \left[\int_{t_b}^t \delta \exp[-v(t-\tau)] d\tau \right] dt \right. \\ \left. + \int_{t_e}^A \left[\int_{t_b}^{t_e} \delta \exp[-v(t-\tau)] d\tau \right] dt \right\}$$

$$[3.2] \quad \ln Y(t) - \ln Y(t_b) = \Psi \delta / v^2 \{ \exp[-v(A - t_b)] - \exp[-v(A - t_e)] \\ + v(t_e - t_b) \}.$$

As illustrated in regard to equation [2.5] above, order 3 power series expressions are used to approximate the two exponential expressions on the RHS of equation [3.2]. The result simplifies to equation [3.3]:

$$[3.3] \quad \ln Y(A) - \ln Y(t_b) = \Psi \delta / 2 \{ (A - t_b)^2 - (A - t_e)^2 + O[A - t_b]^3 + \\ O[A - t_e]^3 \}$$

where:

$$(A - t_b) \geq 0; \text{ and } (A - t_e) \geq 0.$$

Ignoring the third and higher order terms, note that income loss is approximated by a constant, multiplying the difference between the square of the time since onset and the square of the time since discontinuance of the disorder. Note, too, that when the interview is conducted while the respondent is still impaired, that is, in model 2 rather than in model 3, $A = t_e$, and equation [3.3] reduces to equation [2.6].

Estimable Form

A slight change of notation facilitates incorporating overlapping disorder behaviors (and/or psychological dysfunctioning) and leads to

estimable forms for the three models, given the data, which is explained in more detail in other sections of this report. Suppose I_j is an indicator (1/0) of the lifetime DSM-III diagnosis of the disorder j . Time is measured in years of a person's life. A , consequently, is the age of a respondent at the time of an interview. Given that I_j is one, tb_j is the respondent's age at the onset of disorder j , te_j is the respondent's age at his or her last type j disorder, and T is the minimum of A and te . Then e is an error term that includes all of the third and higher order terms, where appropriate, and the fact that the model is an expected value, not a deterministic one.

Substituting these definitions and the error term into the final equations for each model, ([1.3], [2.6], and [3.3]), yields stochastic estimable forms for the three models developed above. The estimable form for model 1 is:

$$[4.1.] \quad \ln Y(A) = \ln Y(tb) + \sum_j \beta_j (T - tb_j) I_j + \epsilon,$$

where:

$$\beta_j = [\Psi \delta_j].$$

The estimable form for model 2 is:

$$[4.2.] \quad \ln Y(A) = \ln Y(tb) + \sum_j \beta_j (T - tb_j)^2 I_j + \epsilon,$$

where:

$$\beta_j = [\Psi \delta_j/2].$$

And, the estimable form for model 3 is:

$$[4.3.] \quad \ln Y(A) = \ln Y(tb) + \sum_j \beta_j \{(A - tb_j)^2 - (A - te_j)^2\} I_j + \epsilon,$$

where:

$$\beta_j = [\Psi \delta_j/2].$$

A strength of this approach is that it allows estimation of different rates of productivity impairment for individuals with the same category of problem. Since information about the relative intensities of disorders are not part of the data base, (quantity-frequency consumption for alcohol, for example), the δ_j parameter is actually suppressed, and the product of the market transformation of the loss and the rate of disorder is estimated, $\Psi \delta_j$.

As equations [4.1] through [4.3] show, the expected level of impairment to income is estimated as the product of the estimated β_j coefficient and a

function of the length of time the individual engaged in the disorder. Separate estimates were made of the β_j coefficients for males and females. Average values of duration of disorder were computed for different age groups, by sex. The actual age groups were chosen to be consistent with the extrapolation and comparative objectives of the larger study. No experimentation was performed to see how sensitive these averages were to choice of age ranges for the groups.

Note that in the absence of ADM disorders, all δ_j values would be zero (and so too would the duration of impairment). Here, the RHSs of equations [4.1] through [4.3] would equal $\ln Y(t_b)$, implying that no loss was experienced from ADM impairments. In all of the models, never engaging in disorders implies never experiencing losses in income. Note also that while a respondent might have a disorder, losses in productivity and income are not assumed to occur unless the respondent has met the DSM-III conditions for an ADM disorder. This is, of course, a simplification consistent with the available data.

Equations [4.1] through [4.3] provide approximations of the specifications of the three ways that disorders may affect income over time. If the measure representing income in the absence of disorders, $\ln(Y(t_b))$, is specified by a linear sum of terms (the reduced form income specification), and an error term is assumed to be distributed as $\text{Normal}(0, \sigma^2)$, maximum likelihood estimates of the β_j coefficients can be estimated. In fact, since income was collected with interval range data, the probability of observing the error associated with any observation is the integral of the error over the range in which it could exist, given the income range. Accordingly, the Grouped Data option in LIMDEP was employed to yield maximum likelihood estimates of the model parameters (Greene, 1990).

APPENDIX D

METHODOLOGY FOR ESTIMATING OTHER RELATED COSTS

Other related costs include the following direct and indirect cost elements for each of the three ADM problems.

<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Mental Illness</u>
Direct Costs		
criminal justice system	criminal justice system	criminal justice system
private legal defense	private legal defense	private legal defense
property destruction	property destruction	social welfare admin.
motor vehicle crashes	drug traffic control	
Indirect Costs		
crime victims	crime victims	family caregiving
incarceration	incarceration	incarceration
	crime careers	

The methodology and sources of data used to estimate each of these cost components are summarized below.

DIRECT COSTS

Criminal Justice System

The public criminal justice system includes four major components: police protection, legal and judicial services, and state, federal, and local corrections. For each component, the costs attributed to alcohol, drug abuse, and mental illness are estimated employing the offense specific methodology developed by Cruze and associates (1981) and Harwood and associates (1984). These costs are presented in Tables D-1 through D-4.

Offense categories are from the Uniform Crime Reporting System (U.S. Dept. of Justice, 1986b), with criminal offenses and arrests divided into Part I and Part II groupings. Nationwide law enforcement agencies provide monthly data on all reports of crime received from victims, officers who discover infractions, and other sources. These data, termed "actual known offenses," are reported regardless of whether an arrest is made or stolen property is recovered. Reports represent the cost of police time spent responding to and investigating complaints of crime. The Part I offenses addressed in this study include:

- Criminal homicide
- Forcible rape and aggravated assault (felonious assault)
- Robbery (taking from a person)
- Burglary (breaking and entering)
- Larceny (theft of property)

Table D-1

PUBLICLY FINANCED CRIMINAL JUSTICE SYSTEM, POLICE PROTECTION COSTS BY TYPE OF OFFENSE, 1985
(\$ in millions)

Type of Offense	Known Offenses[1]		Causal Factors(%) [2]			Police Protection Costs (PPC)[3]			
	Number (1)	Percent of Total (2)	Alcohol Abuse (3)	Drug Abuse (4)	Mental Illness (5)	Alcohol (2)x(3)x Total PPC	Drug (2)x(4)x Total PPC	Mental Illness (2)x(5)x Total PPC	Total ADM
Total	-	-	-	-	-	\$1,338	\$5,810	\$588	\$7,736
Homicide	18,980	.15	30.0	10.0	-	10	3	-	13
Felonious Assault	810,590	6.5	26.9	10.0	-	386	143	-	529
Robbery	497,870	4.0	3.9	26.8	-	34	236	-	270
Burglary	3,073,300	24.7	4.7	22.4	-	256	1,217	-	1,473
Larceny-Theft	6,926,400	55.7	3.8	18.6	-	466	2,279	-	2,745
Auto Theft	1,102,900	8.9	4.6	18.6	-	90	364	-	454
Driving Under Influence	1,788,500[4]	-	100.0	-	-	52[7]	-	-	52
Liquor Laws	548,600[4]	-	100.0	-	-	16[7]	-	-	16
Public Drunkenness	964,800[4]	-	100.0	-	-	28[7]	-	-	28
Stolen Property	127,100[4]	1.1[5]	-	18.6	-	-	45	-	45
Prostitution	113,800[4]	1.0[5]	-	12.8	-	-	29	-	29
Drug Laws	811,400[4]	6.8[6]	-	100.0	-	-	1,494	-	1,494
Disorderly Conduct	671,700[4]	5.6[6]	-	-	10.0	-	-	124	124
Vagrancy	33,800[4]	0.3[6]	-	-	10.0	-	-	6	6
Other Offenses	2,489,200[4]	20.8[6]	-	-	10.0	-	-	458	458
SOURCES: U.S. Department of Justice, 1987c, Table 2, p. 2; 1986b, p. 41.									

[1] Total reported known offenses equals 12,430,000.

[2] See text for a discussion of causal factors.

[3] Total PPC equals \$22 billion.

[4] Total number of persons arrested for each offense.

[5] Based on percent of the total number of persons arrested for non-drug offenses, 11,133,600.

[6] Based on percent of total arrests, 11,945,000.

[7] PPC costs for each alcohol offense estimated at \$28.76 times number of persons arrested per offense (col.1).

The Uniform Crime Reports provide arrest data only for Part II offenses. The Part II offenses addressed in this study include:

- Stolen property (buying, receiving, possessing)
- Prostitution and commercialized vice
- Drug abuse violations (possession, sale, use, manufacture)
- Driving under the influence
- Liquor laws violations
- Drunkenness
- Disorderly conduct

Offense-specific costs are determined by multiplying the percentage of known offenses in each category by a causal factor that represents the proportion of offenses or arrests considered to be due to the effect of alcohol, drug abuse, or mental illness. Cruze and associates (1981) and Harwood and associates (1984) describe in detail how they developed associative estimates of the presence of ADM in violent and property crime, and the proportion of such offenses where ADM could be considered of causal relevance. Following a current review of the literature and discussions with Harwood and Collins, the present study assumes that the causal relationships of alcohol and drug abuse to criminality have remained relatively constant since first described in the 1981 report. Although recent reports indicate that the prevalence of drug abuse has increased dramatically among arrestees in major U.S. cities (Wish, 1987) and among state prison inmates (Innes, 1988), the causal relationships of drug abuse to criminal offense categories in this study are the same as those described by Harwood and associates in 1984. Similarly, the same causal factors relating mental illness to crime in the 1984 report have been used in this study.

Police protection costs (PPC) are presented in Table D-1 and are based on the number of known offenses reported for each Part I offense and on the number of known arrests for Part II offenses, as reported in the Uniform Crime Reports (U.S. Dept. of Justice, 1986b). Offense-specific costs are computed by multiplying the percent of known offenses, (column 2), by the appropriate causal factor, (columns 3, 4, or 5), by the total public expenditure for police protection, which equals \$22 billion for 1985 (U.S. Dept. of Justice, 1987c).

PPC for the alcohol-defined offenses of driving under the influence, liquor law violations, and public drunkenness were computed on a per offense basis. Harwood and associates (1984), using the data presented by Berry and associates (1977), find that the police protection and court costs for each alcohol-defined offense amounted to \$43.68. They assign 50 percent of this cost (\$21.84) each to police protection and court costs. We follow the same procedure and correct this figure for inflation by increasing it to \$28.76. Thus, PPC for alcohol-defined offenses is computed by multiplying the number of persons arrested in each category (column 1) by \$28.76.

Table D-2

PUBLICLY FINANCED CRIMINAL JUSTICE SYSTEM, LEGAL AND ADJUDICATION COSTS BY TYPE OF OFFENSE, 1985
(\$ in millions)

Type of Offense	Known Offenses[1]		Causal Factors (%) [2]			Legal & Adjudication Costs (LAC) [3]			
	No. Cleared by Arrest (1)	Percent of Total (2)	Alcohol Abuse (3)	Drug Abuse (4)	Mental Illness (5)	Alcohol (2)x(3)x Total LAC	Drug (2)x(4)x Total LAC	Mental Illness (2)x(5)x Total LAC	Total ADM
Total	-	-	-	-	-	\$274	\$1,108	\$267	\$1,649
Homicide	13,665	0.1	30.0	10.0	-	3	1	-	4
Felonious Assault	495,578	4.0	26.9	10.0	-	107	40	-	147
Robbery	124,467	1.0	3.9	26.8	-	4	27	-	31
Burglary	430,262	3.5	4.7	22.4	-	16	78	-	94
Larceny-Theft	1,385,280	11.1	3.8	18.6	-	42	206	-	248
Auto Theft	165,435	1.3	4.6	18.6	-	6	24	-	30
Driving Under Influence	1,788,500[4]	-	100.0	-	-	52[7]	-	-	52
Liquor Laws	548,600[4]	-	100.0	-	-	16[7]	-	-	16
Public Drunkenness	964,800[4]	-	100.0	-	-	28[7]	-	-	28
Stolen Property	127,100[4]	1.0[5]	-	18.6	-	-	19	-	19
Prostitution	113,800[4]	1.0[5]	-	12.8	-	-	13	-	13
Drug Laws	811,400[4]	7.0[6]	-	100.0	-	-	700	-	700
Disorderly Conduct	671,700[4]	5.6[6]	-	-	10.0	-	-	56	56
Vagrancy	33,800[4]	0.3[6]	-	-	10.0	-	-	3	3
Other Offenses	2,489,200[4]	20.8[6]	-	-	10.0	-	-	208	208

SOURCES: U.S. Department of Justice, 1987c, Table 2, p. 2; 1986b, pp. 41, 155.

[1] Total reported known offenses equals 12,430,000.

[2] See text for a discussion of causal factors.

[3] Total LAC equals \$10 billion.

[4] Total number of persons arrested for each offense.

[5] Based on percent of the total number of persons arrested for non-drug offenses, 11,133,600.

[6] Based on percent of total arrests, 11,945,000.

[7] LAC costs for each alcohol offense estimated at \$28.76 times the number of persons arrested per offense (col. 1).

Legal and adjudication costs (LAC) are presented in Table D-2 and represent the sum of three categories of expense: courts, prosecution and legal services, and public defense costs (U.S. Dept. of Justice, 1987c). These costs are allocated in proportion to the number of offenses "cleared by arrest" as reported in the Uniform Crime Reports (U.S. Dept. of Justice, 1986b). Law enforcement agencies clear or solve an offense when at least one person is arrested, charged with the commission of the offense, and turned over to the courts for prosecution. For 1985, reporting agencies record a 72 percent clearance rate for murder, 54 percent for forcible rape, 25 percent for robbery, and 62 percent for aggravated assault. In connection with property crime, the clearance rate for burglary is 14 percent, for larceny-theft 20 percent, and for auto theft 15 percent (U.S. Dept. of Justice, 1986b).

LAC for Part I offenses are determined by multiplying the percent of offenses cleared by arrest per category (column 2), by the appropriate causal factor (columns 3, 4, or 5), by the total public expense for judicial and legal services, which equals \$10 billion (U.S. Dept. of Justice, 1987c). LAC for the alcohol-defined offenses or driving under the influence, liquor law violations, and public drunkenness are computed on a per offense basis using the same procedure described previously for police protection costs, that is, by multiplying the number of persons in each category (column 1) by \$28.76.

Determination of correctional costs is a two-step process. First, state and federal costs (SCC) are separated from local correction costs (LCC) because more serious offenders are usually sent to state institutions for longer periods. Local correctional institutions are not dominated by long-term incarcerations and tend to deal with a wider range of offender and offense types (Cruze et al., 1981). Next, the percent of total state and federal prison inmates is determined for each offense category. Offense-specific SCC costs are presented in Table D-3 and are estimated by multiplying this percent (column 3), by the appropriate causal factor (columns 4, 5, or 6), and the total expenditures for state and federal costs, which equals \$8.8 billion for 1985. Local correction costs (Table D-4) are based on the percent of all persons arrested for non-alcohol offenses. This methodology is based on the assumption that the cost of handling a convicted offender at the local level does not vary systematically by offense type (Cruze et al., 1981). For 1985, total local correction costs are \$4.2 billion (U.S. Dept. of Justice, 1987c).

Drug Law Enforcement and Traffic Control

Federal drug control efforts utilize law enforcement strategies to reduce the supply of drugs and conduct treatment and prevention programs to reduce the demand for drugs. For 1985, federal law enforcement or supply reduction programs amount to \$1.4 billion; prevention program costs equal \$175 million (Tables D-5 and D-6). Total expenditures for 1985 are four times the amount spent for these purposes in 1974.

According to the U.S. Office of Management and Budget (1988), federal drug law enforcement activities are conducted by numerous agencies, including the Departments of Agriculture, Defense, Interior, State, Transportation, and Treasury. The total cost amounts to \$1.4 billion for 1985. The Department of Transportation spends the greatest amount (36.9 percent), followed by the Department of Justice (31.6 percent).

Table D-3

PUBLICLY FINANCED CRIMINAL JUSTICE SYSTEM, STATE AND FEDERAL CORRECTION COSTS BY TYPE OF OFFENSE, 1985
(\$ in millions)

Type of Offense[4]	Number of State and Federal Prisoners[1]		Causal Factors(%) [2]				State & Federal Correction Costs[3]			
	Federal Prisoners[1]									
	State (1)	Federal (2)	Percent Federal of Total (3)	Alcohol Abuse (4)	Drug Abuse (5)	Mental Illness (6)	Alcohol (3)x(4)x Total SOC	Drug (3)x(5)x Total SOC	Mental Illness (3)x(6)x Total SOC	Total ADM
Total	-	-	-	-	-	-	\$884	\$2,130	-	\$3,014
Homicide	66,276	1,445	13.5	30.0	10.0	-	357	119	-	476
Felonious Assault	77,384	1,084	15.6	26.9	10.0	-	368	137	-	505
Robbery	96,846	7,128	20.6	3.9	26.8	-	71	485	-	556
Burglary	76,457	111	15.2	4.7	22.4	-	63	299	-	362
Larceny-Theft	27,803	2,987	6.1	3.8	18.6	-	20	100	-	120
Auto Theft	6,487	28	1.3	4.6	18.6	-	5	21	-	26
Stolen Property	9,267	-	1.8	-	18.6	-	-	29	-	29
Prostitution	-	-	-	-	12.8	-	-	-	-	-
Drug Laws	39,850	13,796	10.7	-	100.0	-	-	940	-	940
Disorderly Conduct	-	-	-	-	-	10.0	-	-	-	-
Vagrancy	-	-	-	-	-	10.0	-	-	-	-
Other Offenses	-	-	-	-	-	10.0	-	-	-	-

SOURCES: U.S. Department of Justice, 1987c, Table 2, p. 2; 1986d, Table 6.25, p. 404 and Table 6.41, p. 417; 1988, Table 3, p. 3.

[1] Total number of state and federal prisoners equals 503,601.

[2] See text for a discussion of causal factors.

[3] Total SOC equals \$8,787 million.

[4] No state and federal prisoners were incarcerated for alcohol-related offenses of driving under the influence, liquor laws and public drunkenness.

Table D-4

PUBLICLY FINANCED CRIMINAL JUSTICE SYSTEM, LOCAL CORRECTION COSTS BY TYPE OF OFFENSE, 1985
(\$ in millions)

Type of Offense	Known Arrests [1]		Causal Factors (\$) [2]			Local Correction Costs (LOC) [3]			
	Number (1)	Percent of Total (2)	Alcohol Abuse (3)	Drug Abuse (4)	Mental Illness (5)	Alcohol (2)x(3)x Total LOC	Drug (2)x(4)x Total LOC	Mental Illness (2)x(5)x Total LOC	Total ADM
Total	-	-	-	-	-	\$1,238	\$460	\$113	\$1,811
Homicide	18,330	.15	30.0	10.0	-	2	1	-	3
Felonious Assault	342,360	2.9	26.9	10.0	-	33	12	-	45
Robbery	136,870	1.1	3.9	26.8	-	2	13	-	15
Burglary	443,300	3.7	4.7	22.4	-	7	35	-	42
Larceny-Theft	1,348,400	11.3	3.8	18.6	-	18	89	-	107
Auto Theft	113,900	1.1	4.6	18.6	-	2	9	-	11
Driving Under Influence	1,788,400	.15	100.0	-	-	636	-	-	636
Liquor Laws	548,600	4.6	100.0	-	-	195	-	-	195
Public Drunkenness	964,800	8.1	100.0	-	-	343	-	-	343
Stolen Property	127,100	1.0	-	18.6	-	-	8	-	8
Prostitution	113,800	1.0	-	12.8	-	-	5	-	5
Drug Laws	811,400	6.8	-	100.0	-	-	288	-	288
Disorderly Conduct	671,700	5.6	-	-	10.0	-	-	24	24
Vagrancy	33,800	.3	-	-	10.0	-	-	1	1
Other Offenses	2,489,200	20.8	-	-	10.0	-	-	88	88
SOURCES: U.S. Department of Justice, 1986b, p. 164.									

[1] Total known arrests equals 11,945,000.

[2] See text for a discussion of causal factors.

[3] Total LOC equal \$4,246 million.

Table D-5

FEDERAL FUNDS FOR DRUG LAW ENFORCEMENT BY AGENCY, 1974 and 1985

<u>FEDERAL AGENCY</u>	<u>1974</u>		<u>1985</u>	
	<u>Amount</u> <u>(millions)</u>	<u>Percent</u> <u>Distri-</u> <u>bution</u>	<u>Amount</u> <u>(millions)</u>	<u>Percent</u> <u>Distri-</u> <u>bution</u>
Total	\$255.4	100.0	\$1,380.3	100.0
Justice	124.9	48.9	436.2	31.6
Drug Enforcement Administration			331.7	24.0
Interpol			0.1	*
Immigration and Naturalization Service			0.5	*
Federal Bureau of Investigation			103.9	7.5
Treasury			326.8	23.7
Customs	66.2	25.9	255.9	18.5
Internal Revenue Service	19.7	7.7	61.6	4.5
Bureau of Alcohol, Tobacco and Firearms			9.3	.7
Transportation	.1	.4	508.7	36.9
U.S. Coast Guard			508.2	36.8
Federal Aviation Administration			0.5	*
State			56.8	4.1
International Narcotics Matters			51.6	3.7
Agency for International Development	42.7	16.7	4.2	.3
U.S. Information Agency			1.0	.1
Agriculture			4.4	.3
Agricultural Research Service	1.8	.7	1.4	.1
U.S. Forest Service			3.0	.2
Interior			3.4	.2
Bureau of Land Management			0.2	*
U.S. Park Service			0.8	.1
Bureau of Indian Affairs			2.0	.1
Fish & Wildlife Service			0.4	*
Defense			44.0	3.2

* Less than 0.5 percent

SOURCES: U.S. Office of Management and Budget, 1988; Inciardi and Chambers, 1974.

Federal funds for drug traffic control prevention amount to \$175 million for 1985, distributed to the following agencies: Defense, Education, Health and Human Services, Justice, and Labor (Table D-6). About three-fifths of the \$175 million is spent by ADAMHA within the Department of Health and Human Services.

Private Expenditures

In addition to funds spent in the public sector, considerable sums of money are spent by private individuals for legal defense against criminal charges related to alcoholism. Legal defense charges are calculated following the methodology developed by Cruze and associates (1981). It is assumed that the expenditures for private legal services attributable to ADM crime are the same proportion of total private legal expenditures as ADM costs for public legal services are of total public legal costs. Total public legal and adjudication costs for 1985 are \$10.1 billion. The U.S. Bureau of the Census (1987b) lists the total annual payroll for private legal services at \$12.5 billion. Private defense costs due to ADM as shown in Table 52 are calculated as follows:

Alcohol Abuse:

$$\frac{\$274 \text{ million}}{\$10,070 \text{ million}} \times \$12,544 \text{ million} = \$342 \text{ million}$$

Drug Abuse:

$$\frac{\$1,108 \text{ million}}{\$10,070 \text{ million}} \times \$12,544 \text{ million} = \$1,381 \text{ million}$$

Mental Illness:

$$\frac{\$267 \text{ million}}{\$10,070 \text{ million}} \times \$12,544 \text{ million} = \$333 \text{ million}$$

Property Destruction

Property that is damaged or destroyed by crime represents another related direct cost to society. Data from the National Crime Survey Report (U.S. Dept. of Justice, 1987a) provide the value of damaged/ destroyed property due to robbery, assault, larceny, burglary, and motor vehicle theft amounting to \$3.9 billion for 1985. Applying the offense-specific causal factors developed by Cruze and associates (1981) results in estimates of \$175 million due to alcohol abuse and \$759 million due to drug abuse (Table D-7).

Motor Vehicle Crash Costs

Although drug abuse and mental illness may be causal factors in auto crashes, we are unable to find data that support such causal relationships. Accordingly, we follow the approach used by Cruze and associates (1981) and estimate this cost element only for alcohol abuse.

Berry and associates (1977), Faigin (1976), Cruze and associates (1981) and Blincoc (1987) include several specific cost elements in estimating motor vehicle

TABLE D-6

FEDERAL FUNDS FOR DRUG TRAFFIC CONTROL BY AGENCY, 1974 and 1985

<u>FEDERAL AGENCY</u>	<u>1974</u>		<u>1985</u>	
	<u>Amount</u> <u>(millions)</u>	<u>Percent</u> <u>Distri-</u> <u>bution</u>	<u>Amount</u> <u>(millions)</u>	<u>Percent</u> <u>Distri-</u> <u>bution</u>
Total	\$140.4	100.0	\$174.7	100.0
Defense	24.1	17.2	57.8	33.1
Education			3.7	2.1
Health and Human Services (ADAMHA)	84.9	60.4	105.9	60.6
Justice	4.2	3.0	.1	.1
Labor			.3	.2
Domestic Volunteer Service Programs	27.2	19.4	6.9	3.9

SOURCES: U.S. Office of Management and Budget, 1988; Inciardi and Chambers, 1974.

Table D-7

PROPERTY DESTRUCTION DUE TO CRIME BY TYPE OF CRIME, 1985
(\$ in millions)

<u>Type of Crime</u>	<u>Total Value</u>	<u>Causal Factor(%)</u>		<u>Amount Due To:</u>	
		<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>
Total	\$3,912			\$175	\$759
Robbery	100	3.9	26.8	4	27
Assault	58	26.9	0.0	16	0
Personal Larceny	1,540	3.8	18.6	59	286
Burglary	908	4.7	22.4	43	203
Household Larceny	940	3.8	18.6	36	175
Motor Vehicle Theft	365	4.6	18.6	17	68
Total	\$3,912			\$175	\$759

SOURCE: U.S. Department of Justice, 1987a, pp. 66-67.

Table D-8

MOTOR VEHICLE CRASH COSTS DUE TO ALCOHOL ABUSE BY TYPE OF COST, 1985
(millions)

<u>Type of Cost</u>	<u>Total</u>	<u>Fatalities</u>	<u>Injury Severity</u>		<u>Property Damage Only</u>
			<u>Severe/ Critical Injury</u>	<u>Minimum/ Moderate Injury</u>	
All motor vehicle crashes:					
Legal/court costs	\$4,234	\$805	\$645	\$2,293	\$491
Insurance administration	9,031	838	554	2,542	5,097
Vehicle damage	26,848	205	446	3,719	22,478
Total	40,113	1,848	1,645	8,554	28,066
Due to alcohol abuse:					
Percent	6.4	37	9.75	10.5	3.0
Amount	2,584	684	160	898	842

SOURCE: Adapted from Blincoe, 1987, Table 5, p. 6.

crash costs. They also divide accidents with personal injuries by the severity of injury, using a 5-point Abbreviated Injury Scale (AIS), with minimum/moderate injuries represented by categories AIS 1 and AIS 2 and severe and critical injuries by categories AIS 3 through AIS 5.

In the present report, only three cost elements are included: legal and adjudication costs, insurance administration, and vehicle damage. The cost estimates are based on the following factors: 1) the number of fatalities, property damage only, and accidents with injuries classified by AIS severity level; 2) the costs per category for 1985; and 3) the percent of auto crashes in each AIS category caused by alcohol abuse. The latter was determined using causal factors developed by Berry and associates (1977) and Cruze and associates (1981).

Information on the number of fatalities, property damage only, accidents and number of injuries is obtained from the National Highway Traffic Safety Administration (Blincoe, 1987). Figures for 1986 are deflated to 1985 using the CPI all-items index. The total motor vehicle crash costs due to alcohol abuse amount to \$2.6 billion (Table D-8).

Fire Destruction

The cost estimates for destruction of property by fire due to alcohol abuse are obtained from data published by the National Fire Protection Association (U.S. Bureau of the Census, 1987c). The total amount of property destroyed by fire for 1985 equals \$6.4 billion. Applying the causal factor of 6.1 percent developed by Berry and associates (1977) and used by Cruze and associates (1981), the amount due to alcohol abuse is \$457 million.

Social Welfare Administration

In estimating these costs, we first reviewed the specific social welfare programs identified by Cruze and associates (1981) as having large numbers of participants with ADM problems. These include Old Age, Survivors, and Disability Insurance (OASDI), unemployment insurance, railroad temporary disability insurance, state temporary disability insurance, workers compensation, public assistance, supplemental security income, food stamps, veterans pensions and rehabilitation, and vocational rehabilitation. All of these programs were still active in 1985 and deemed relevant for inclusion in the present report.

The total expenditures for each program and data for each program were supplied by Bixby (1988) in the Social Security Administration. ADM costs are calculated using the illness-specific causal factors developed in 1981 by Cruze and associates.

Social welfare administrative costs due to ADM problems amount to \$471 million for 1985, as shown in Table D-9. Of this amount, \$377 million, or 80 percent, is attributable to mental illness.

INDIRECT COSTS

Four types of other related indirect costs are estimated: productivity losses for victims of crime, for individuals incarcerated in prisons, and for those

Table D-9

ADMINISTRATIVE COSTS OF PUBLIC SOCIAL WELFARE PROGRAMS BY PROGRAM, 1985
(\$ in millions)

Program	Administrative Costs		Percent Due To				ADM Administrative Costs			
	Total Expenditures	Percent Amount (1)	Alcohol Abuse		Drug Abuse		Alcohol Abuse		Drug Abuse	
			(2)	(3)	(4)	(5)	(1)x(2)	(1)x(3)	(1)x(4)	Total
Total	\$112,812	-	\$8,244	-	-	-	\$88	\$6	\$377	\$471
OASDI Payments	18,827	1.2	226	2.6	.3	8.5	6	.68	19	25.7
Unemployment Insurance	18,334	12.1	2,224	-	-	-	-	-	-	-
Railroad Temporary Disability Insurance	51	11.8	6	2.6	.3	8.5	*	*	.5	.7
State Temporary Disability Insurance	2,000	4.0	80	2.6	.3	8.5	2.0	*	7	9.2
Workers' Compensation[1]	15,184	7.4	1,128	-	-	-	-	-	-	-
Public Assistance[2]	19,426	11.4	2,214	.5	-	1.6	11	-	35	46
Supplemental Security Income	11,840	8.0	942	1.9	-	14.4	18	-	136	154
Food Stamps	11,701	7.8	913	.5	-	1.6	5	-	15	20
Veterans Pensions and Rehabilitation	14,256	3.2	456	10.2	1.1	33.8	46	-	154	200
Vocational Rehabilitation	1,183	4.7	55	-	-	18.8	-	5	10	15

SOURCES: Bixby, 1988, pp. 23-25; Social Security Administration, Office of Research and Statistics, personal communication; and Cruze et al., 1981, pp. A92-A95.

* Less than \$500,000.

[1] Excludes hospital and medical benefits.

[2] Excludes vendor payments and social services.

who engage in crime as a career. Also included are the imputed value of time spent by caregivers of mentally ill family members.

Victims of Crime

Productivity losses or the value of time lost from work by victims of crime are calculated using the offense-specific crime/alcohol and crime/drug causal factors developed by Cruze and associates (1981), applied to data obtained from the National Crime Survey (U.S. Dept. of Justice, 1987a). A total of 34,683 persons were criminally victimized in 1985, with the average number of work days lost per criminal offense ranging from 1.7 to 4.6 days (Table D-10). The 1985 annual average earnings adjusted for wage supplements equal \$21,823 for men and \$11,493 for women, or \$66 per day for men and women (U.S. Bureau of the Census, 1987b). The value of lost productivity due to criminal victimization is estimated by multiplying \$66 per day times the proportion of offenses due to alcohol or drug abuse, times the average work days lost for each type of criminal offense. The total value as shown in Table D-10 equals \$1.3 billion, of which \$842 million, or 64 percent, is attributable to drug abuse.

Incarceration

The value of lost productivity of incarcerated individuals is estimated following the approach used by Cruze and associates (1981). The number of persons incarcerated due to ADM related offenses is calculated along with an estimation of the amount of time incarcerated for the crime (Table D-11). A value is then attached to the estimated amount of time spent incarcerated per offense type.

The basic data are from 1985 surveys of jail inmates and state and federal prison inmates. As shown in Table D-11, the number of persons incarcerated in state and federal prisons for 1985 totals 503,601, and the number in local jails is 104,435 (U.S. Dept. of Justice, 1986d). We follow the assumption used by Cruze and associates (1981) that both the number of persons incarcerated and the proportion incarcerated for specific offenses remains relatively constant throughout the year. Thus, the number of incarcerated persons during 1985 represents the number of person years lost to productivity for the whole year.

The value of productivity losses due to incarceration is calculated by estimating demographic characteristics for men and women and multiplying by the annual mean earnings for each gender group. The demographic data from the Cruze et al. (1981) report are used, in which it is assumed that 97.4 percent of those incarcerated are men and 2.6 percent are women. The 1985 average, year-round, full-time mean earnings adjusted for supplements and fringe benefits is \$32,400 for men and \$20,119 for women (U.S. Bureau of the Census, 1987b).

Productivity losses due to incarceration are presented in Table D-12. Losses due to alcohol abuse equal \$2.7 billion. The largest components are alcohol-related felonious assault (\$791 million), homicide (\$753 million), and drunk driving (\$595 million).

Drug abuse incarceration losses are much greater than those for alcohol abuse, totaling \$4.4 billion. Drug law violations represent the largest component, equaling \$1.9 billion. Robbery incarceration losses are \$977 million and burglary losses are \$624 million.

Table D-10

PRODUCTIVITY LOSSES FOR VICTIMS OF CRIME BY TYPE OF CRIME, 1985
(\$ in millions)

<u>Type of Crime</u>	<u>Number (000s)</u>	<u>Average Work Days Lost</u>	<u>Percent Due to</u>		<u>Productivity Losses [1]</u>		<u>Total ADM</u>
			<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	<u>Alcohol Abuse</u>	<u>Drug Abuse</u>	
Total	34,863	-	-	-	\$465	\$842	\$1,307
Rape	138	4.6	26.9	10.0	11	4[3]	15
Assault	4,699	3.7	26.9	10.0	309	115	424
Robbery	985	4.4	3.9	26.8	11	77	88
Burglary	5,594	1.7	4.7	22.4	29	141	170
Larceny	22,177	1.7	3.8	18.6	95	463	558
Auto Theft	1,270	2.7	4.6	18.6	10	42	52

SOURCES: U.S. Department of Justice, 1986a, Table 1, p. 12, and Table 84, p. 72.

[1] Based on average earnings of \$66 per day.

Table D-11

NUMBER OF INCARCERATIONS AND PERSON YEARS SERVED DUE TO ADM. BY TYPE OF OFFENSE AND SEX, 1985

Type of Offense	Incarcerations Due to Offense in 1			Percent of Offenses Due to;			Person Years Served for Crime in 1985 Due to:					
	Federal & State Prison	Local Jails	Total	Alcohol Abuse	Drug Abuse	Mental Illness	Alcohol Abuse		Drug Abuse		Mental Illness	
							Males	Females	Males	Females	Males	Females
Total	503,601	104,435	608,036				81,992	2,189	134,611	3,593	9,881	264
Homicide	67,643	10,629	78,272	30.0	10.0	—	22,871	611	7,624	204	—	—
Felonious Assault	78,470	13,199	91,669	26.9	10.0	—	24,018	641	8,929	238	—	—
Robbery	103,965	9,717	113,682	3.9	26.8	—	4,318	115	29,675	782	—	—
Burglary	76,578	10,203	86,781	4.7	22.4	—	3,973	106	18,934	505	—	—
Larceny	30,778	7,288	38,066	3.8	18.6	—	1,408	38	6,896	184	—	—
Auto Theft	6,527	1,590	8,117	4.6	18.6	—	364	10	1,471	39	—	—
Drug Laws	53,653	7,067	60,720	—	100.0	—	—	—	59,141	1,579	—	—
Receiving Stolen Property	9,267	1,458	10,725	—	18.6	—	—	—	1,943	52	—	—
Drunk Driving	—	18,550	18,550	100.0	—	—	18,068	482	—	—	—	—
Liquor Laws	3	—	3	100.0	—	—	3	—	—	—	—	—
Drunkenness, Vice, Vagrancy	—	7,950	7,950	90.0	—	10.0	6,969	186	—	—	774	21
All Other Offenses	76,717	16,784	93,501	—	—	10.0	—	—	—	—	9,107	243

SOURCES: U.S. Dept. of Justice, 1985, Table 5, p. 4; 1986c, p. 2; 1987b, Table 1, p. 2; 1987e, Table 4, p. 3; 1988 Table 3, p. 3; 1988, pp. 20-21.

NOTE: Percent of Offenses from Cruze et al., 1981, pp. A80-84.

Table D-12

PRODUCTIVITY LOSSES* DUE TO INCARCERATION, BY TYPE OF OFFENSE AND SEX, 1985
(in Millions)

Type of Offense	Alcohol Abuse			Drug Abuse			Mental Illness		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
Total	\$7,460	\$7,338	\$122	\$2,701	\$2,657	\$44	\$4,434	\$4,361	\$72
Homicide	1,004	988	16	753	741	12	251	247	4
Felonious Assault	1,085	1,067	18	791	778	13	294	289	5
Robbery	1,120	1,101	18	142	140	2	977	961	16
Burglary	754	742	12	131	129	2	624	613	10
Larceny	274	269	4	46	46	1	227	223	4
Auto Theft	60	59	1	12	12	—	48	48	1
Drug Laws	1,948	1,916	32	—	—	—	1,948	1,916	32
Receiving Stolen Property	64	63	1	—	—	—	64	63	1
Drunk Driving	595	585	10	595	585	10	—	—	—
Liquor Laws	—	—	—	—	—	—	—	—	—
Drunkennes, Vice, Vagrancy	255	251	4	230	228	4	—	—	—
All Other Offenses	300	295	5	—	—	—	—	—	—
							26	25	5
							300	295	5

*Based on average annual earnings for males -- \$32,400 and for females -- \$20,119.

SOURCE: Table D-11.

Mental illness incarceration losses amount to \$325 million, and \$300 million is represented in the category "other offenses," which includes manslaughter, other violent crimes, fraud, and public order offenses such as possession of a weapon, obstructing justice, traffic, rioting, and family-related offenses.

Crime Careers

A primary source of other related indirect costs of ADM problems is the lost productivity of people who engage in criminal activity as a result of drug abuse. The economic value of this cost element is difficult to quantify for two reasons. First, although it is known that heroin and cocaine addicts commit a large number of income-generating crimes, recent research indicates that these individuals often hold jobs and have income from both legitimate and illegal activities. Second, the distinction between drug abuse and drug addiction is not clear. In this report, we use the definition by Nurco and associates (1985) of a narcotic addict as "a person who has used opium or its derivatives or synthetics, for non-medical reasons for four or more days per week for at least one month while at large in the community."

Heroin and cocaine users are considered the major source of lost productivity due to drug abuse. These losses are determined by first estimating the prevalence of heroin and cocaine addiction. Next, an estimate is made of the proportion of this population by age and sex that engages in criminal activity as a result of drug addiction. The value of lost productivity is then determined by multiplying the number of people in each age group by the appropriate 1985 mean annual earnings shown in Table D-13.

The prevalence data for heroin and cocaine abuse are from estimates made by the National Narcotics Intelligence Consumers Committee (NNICC, 1987) and personal discussions with the Division of Epidemiology and Statistical Analysis at the National Institute on Drug Abuse (NIDA). According to these sources, the number of heroin addicts has remained relatively constant through the 1980s, at approximately 500,000. Regarding cocaine use, about 12 million people use it once a year, 3 to 5 million use it twelve or more times, and approximately 1 million are considered to be dependent or addicted (E. Adams, National Institute on Drug Abuse, personal communication, 1988).

To estimate the proportion of addicts who engage in crime, we deduct from the 1.5 million total the 138,204 persons who are incarcerated in prisons for drug abuse (see Table D-10), which leaves 1,361,796 addicts at large in the community. Nurco and associates (1985) state that the typical addict commits one or more criminal offenses every second day per year. Thus, we assume that 50 percent, or 680,898 persons, used crime during 1985 to support their habit. Demographic data from the National Household Survey on Drug Abuse (NIDA, 1988) are used to compute the number of drug addicts by age and sex. The productivity losses are computed by multiplying the number of people in each age group by the mean annual earnings figures discussed above.

The total value of lost productivity is shown in Table D-13 and equals almost \$14 billion, of which 71 percent represents losses for men and 29 percent for women. By age group, those aged 26-34 account for almost half the total losses.

TABLE D-13

PRODUCTIVITY LOSSES DUE TO CRIME CAREERS ASSOCIATED WITH DRUGS BY AGE AND SEX, 1985

Age	Number of Persons*			Mean Annual Earnings		Productivity Losses (millions)		
	Total	Males	Females	Males	Females	Total	Males	Females
TOTAL	680,898	433,451	247,447	-	-	\$13,976	\$9,877	\$4,099
12-17	53,623	32,956	20,667	\$6,706	\$6,353	352	221	131
18-25	298,277	184,328	113,949	16,891	14,086	4,718	3,113	1,605
26-34	255,267	169,806	85,461	28,428	20,908	6,614	4,827	1,787
35 and over	73,731	46,361	27,370	37,015	21,039	2,292	1,716	576

* Number of persons forgoing legitimate productive pursuits.

SOURCES: National Institute on Drug Abuse, 1988, Table 14A, p 14; U.S. General Accounting Office, 1988a, p. 11; Nurco et al., 1985, pp. 113-115; and U.S. Bureau of the Census, 1987b, Table 36, p. 60.

Family Caregivers

The value of time spent by caregivers for care provided to mentally ill family members is estimated by Franks (1987) in a study conducted for the National Institute of Mental Health. Included is time spent in the following activities: caregiving; work loss; time with lawyers, clergy, and professionals; recreation; and other. Franks estimates a total value of time spent by caregivers of \$2.5 billion, based on a survey of the membership of the Massachusetts Alliance for the Mentally Ill, a family support and advocacy group.

APPENDIX E

FORMULA FOR CALCULATING THE PRESENT VALUE OF LIFETIME EARNINGS

MORTALITY

The formula for calculating the present value of lifetime earnings is presented below:

$$V = \sum_{n=a}^{85+} \frac{(X_n W_n P_a^n + H_n K_n P_a^n)}{(1+i)^{n-a}}$$

Where

a is the midyear age for the given cohort of persons

X_n is the annual mean earnings for all persons with earnings in an age group where the midpoint is age **n**

i is the discount rate

H_n is the annual mean imputed value of housekeeping services for all persons in an age group where the midpoint is age **n**

K_n is the average keeping house participation rate in the age group with midpoint age **n**

W_nP_aⁿ is defined as the number of labor force years per person in an age group and determined as follows:

$$W_n P_a^n = \frac{\sum_{j=t}^{t+r-1} L_j W_j}{L_a}$$

Where

j is the specific single year of age under consideration

t is the beginning year of the age group

r is the number of years in this age group; in any age group **j** can go from **t** to **t + r - 1**

L_j is the number of individuals surviving to **j** out of a cohort of 100,000 live births, based on 1985 Life Tables, National Office of Vital Statistics

W_j is the single year labor force participation rate

L_a is the number of persons living at the midyear age a for the given single subgroup out of a cohort of 100,000 live male births

P_a^n is the approximate probability that an individual age a survives to n

W_n is the average labor force participation rate in the age group with midyear age n , resulting from the single year labor force participation rate W

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